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Social Value Orientation: Theoretical and Measurement Issues in the Study of Social Preferences

Ryan O. Murphy[1] and Kurt A. Ackermann[1]

Abstract

What motivates people when they make decisions and how those motivations are potentially entangled with concerns for others are central topics for the social, cognitive, and behavioral sciences. According to the postulate of narrow self-interest, decision makers have the goal of maximizing personal payoffs and are wholly indifferent to the consequences for others. The postulate of narrow self-interest—which has been influential in economics, psychology, and sociology—is precise and powerful but is often simply wrong. Its inadequacy is well known and efforts have been made to develop reliable and valid measurement methods to quantify the more nuanced social preferences that people really have. In this paper, we report on the emergence and development of the predominant conceptualization of social preferences in psychology: social value orientation (SVO). Second, we discuss the relationship between measurement and theory development of the SVO construct. We then provide an overview of the literature regarding measurement methods that have been used to assess individual variations in social preferences. We conclude with a comparative evaluation of the various measures and provide suggestions regarding the measures' constructive use in building psychologically realistic theories of people's social preferences.

Keywords

individual differences, helping/prosocial behavior, motivation/goals, behavioral economics, judgment/decision making, research methods, social cognition

> No man is an island, entire of itself; every man is a piece of the continent, a part of the main. If a clod be washed away by the sea, Europe is the less, as well as if a promontory were, as well as if a manor of thy friend's or of thine own were.
>
> —John Donne
> Devotions on Emergent Occasions
> Meditation XVII

People often cooperate with each other—they help others in need, volunteer their efforts, contribute money and goods to causes, and even donate blood—all to benefit unrelated and anonymous others without the expectation of gain or reward. Why people choose to cooperate and act prosocially is a deep question that has fostered active research areas across many disciplines, including biology and all the social and behavioral sciences. A prerequisite for many kinds of cooperative behavior is that decision makers (DMs) consider the well-being of others when contemplating their options. That is to say that people may have *social preferences* and that these preferences promote behavior that is beneficial to others even though it is costly to the actor.

To illustrate the notion of social preferences, consider the following choice between two options shown in Table 1. In this example, the DM is selecting between certain distributions of resources, yielding some amount to herself and some amount to another person. The DM and the other person will remain mutually anonymous during and after the decision is made, and there is nothing the other person can do to affect the DM in any way. Hence, this is not a strategic decision (i.e., not within the purview of game theory, as only one DM influences the payoffs for both people) but rather is a one-shot individual decision under certainty, free of potential

Table 1. A Simple Binary Choice Between Two Allocation Options.

Option 1	Option 2
\$85 to the DM	\$100 to the DM
\$85 to another person	\$50 to another person

Note. DM = decision maker.

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repercussions or reprisals. Nonetheless, this choice has a social dimension, as the DM will have an effect on another person, and the DM is aware of this potential consequence. Choices in this austere context can reveal a great deal about a DM's social preferences. These preferences affect behavior in situations of interdependence (Kelley & Thibaut, 1978), and choices such as this can provide insight into how much (if at all) a DM cares about her own payoff in conjunction with the payoff for another person.

The "rational" solution to this choice is trivial: A payoff-maximizing DM (i.e., *Homo economicus*) would select Option 2 because it results in a larger individual payoff. Choosing Option 2 over Option 1, thereby gaining an extra $15 at a cost of $35 to another person, is inconsequential from the normative vantage point; the only pertinent consideration is the DM's individual payoff, irrespective of the payoff to the other. In this instance, the normative account clearly diverges from actual behavior. We find that about 65% of incentivized DMs from a large representative sample, in an anonymous one-shot decision context, choose the prosocial option, a finding that is consistent with other empirical results (Au & Kwong, 2004; Balliet, Parks, & Joireman, 2009; Bogaert, Boone, & Declerck, 2008; Van Lange, Otten, De Bruin, & Joireman, 1997).

Clearly, these choice results are incongruent with the postulate of narrow self-interest. Social preferences, however, are often more complex than those assumed under this rubric. Individual differences in how much concern a person has for others have been of interest to a wide range of researchers. This construct has been widely studied in parallel under a variety of different names, including social preferences, other-regarding preferences, social motives, welfare tradeoff ratios, altruism, collective interest, and social value orientation (SVO). The rich lexical variety for the same concept is heartening (as there is widespread interest in the idea of human nonselfishness) but disheartening as well (as different cliques of active researchers operate largely unbeknownst to each other, all the while sharing common intellectual interests). One of our intentions here is to bring together these related but independent lines of research by examining the ways that the elemental construct of social preferences has been conceptualized and measured. The persistent balkanization of research on this topic can be attributed in part to measuring the same thing in different ways; we hope to bridge existing divides by suggesting common measurement methods to establish commensurability.

The structure of the paper is as follows. First, we briefly describe the historical developments that resulted in a well-established theoretical framework for considering social preferences and describe this framework in detail. Then, we offer a broad review of literature from across the social sciences, discussing existing measurement methods of social preferences, roughly in chronological order of development. Strengths and weaknesses of each method are discussed, and the measures are evaluated according to a predefined set of criteria. We conclude with a brief discussion of how a reliable metric of social preferences can inform and support psychologically realistic and descriptively accurate theories of social decision making with an emphasis on the use of high-resolution measures.

Theoretical Background and the Emergence of the SVO Concept

Early theoretical work on interdependent decision making primarily focused either on characterizing situations of social encounters in terms of their potential to provoke cooperation or competition (e.g., Deutsch, 1949) or on how people's attitudes and emotions shape the relationships in which they are involved (e.g., Heider, 1958). It was a natural next step to analyze the situation and intrapersonal processes when examining the behavior of interdependent DMs, consistent with Lewin's (1936) suggestion to conceptualize behavior as a simultaneous function of person and situation. With the emergence of game theory (see Luce & Raiffa, 1957; Von Neumann & Morgenstern, 1944), a formal way to describe situations of interdependent decision making, normative predictions of rational behavior in a given situation became possible. Nonetheless, this precision came at the cost of often unrealistically strong assumptions about people's preferences.

Strongly influenced by the concepts and approach of game theory, researchers have built theories of social interactions that take into account the incentive structures that characterize situations of interdependence while also, at least implicitly, assuming that people vary in how they perceive and evaluate particular incentive structures (e.g., Homans, 1961; Thibaut & Kelley, 1959). The explicit assumption that people enter situations of interdependence with individual goals that may lead to different behavior in the same interdependent situation was stated and studied by Deutsch (1960) who proposed three motivational orientations: cooperative, individualistic, and competitive. This terminology was later adopted by Messick and McClintock (1968) in their motivational theory of choice behavior that was stimulated by a series of studies showing that people do not strictly endeavor to maximize their own payoffs when making choices in interdependent contexts but rather tend to take into account the other player's payoff as well (McClintock & McNeel, 1966a, 1966b, 1966c, 1967; Messick & Thorngate, 1967). In this theory, the three motivations identified by Deutsch were operationally defined as the goals to maximize joint gains (cooperative), maximize own gain (individualistic), and maximize relative gain (competitive). Messick and McClintock (1968) further showed that choice options in formal games may dominate[1] others with respect to one or more of the three stated motivational orientations, and that it is possible to assess a person's primary motivational orientation by observing his or her choices in a series of what they called *decomposed games* (see also Pruitt, 1967).

Basically, any unilateral choice among different allocations of resources for oneself and another person is a decomposed game. If two DMs would each make such a choice and each would receive what they allocated to themselves and what the other person allocated to the other, the situation would constitute a proper (i.e., recomposed) game. The purpose of presenting people with decomposed games is that mutual interdependence is removed from the situation so that options chosen in these tasks express a DM's social preferences alone rather than their preferences confounded with strategic considerations. This only holds true if people are not directly paired with each other when making decisions in a decomposed game. Otherwise the situation is a proper (i.e., recomposed) game. Messick and McClintock's seminal work led both to a conceptualization of social preferences (Griesinger & Livingston, 1973; McClintock, 1972) that was later termed *Social Value Orientation* and the use of decomposed games with a few discrete options as a method for assessing these preferences.

The general notion that individual differences are noteworthy and crucial for explaining behavior in situations of interdependence was also adopted in broader theoretical frameworks. For example, in goal/expectation theory, Pruitt and Kimmel (1977) assumed that the choices people make in experimental games depend on their motives and their beliefs about the anticipated behavior of their interaction partner. Highlighting the importance of both of these determinants of behavior, Pruitt and Kimmel recommended that "measures of goals and expectations should be routinely introduced into gaming studies" (p. 385). The assumption that social preferences affect choices in experimental games is also inherent to the theory of interdependence by Kelley and Thibaut (1978) that postulated people vary in their perceptions of a given situation due to individual differences in the goals they pursue. Concretely, when people decide which strategy to use when engaged in an interdependent situation represented by a matrix game, it is hypothesized that they transform the *given matrix* into a subjective *effective matrix*, which then serves as the basis for their final choice. For instance, if people have the goal to maximize joint payoffs—thereby expressing a cooperative motivation—they would sum the payoffs for themselves and for the other person per outcome from the *given matrix*, then internally represent the *effective matrix* containing the computed sums of payoffs as outcomes, and finally choose an option based on this subjective representation of the joint payoffs. Thus, the SVO concept is implicitly embedded in Kelley and Thibaut's theory as the driver of payoff matrix transformation.

Subsequent theoretical work on SVO focused on issues such as linking the SVO concept with rules of fairness (McClintock & Van Avermaet, 1982); integrating it into an evolutionary perspective on behavior in situations of interdependence (McClintock, 1988); and embedding it into a broader context of social interactions in general (Van Lange, De Cremer, Van Dijk, & Van Vugt, 2007). However, many theoretical advancements regarding SVO have been achieved on a more basic level, that is, refining the concept itself (e.g., Van Lange, 1999), or devising and testing theories of the ontogenetic development of SVO (Van Lange et al., 1997), or of its relation to other concepts, such as beliefs, perceptions, or attitudes concerning others (see, for instance, Bogaert et al., 2008; Kelley & Stahelski, 1970; Liebrand, Jansen, Rijken, & Suhre, 1986; Van Lange & Liebrand, 1991).

Although there are several excellent reviews of SVO and substantial findings associated with it (Au & Kwong, 2004; Balliet et al., 2009; Bogaert et al., 2008; McClintock & Van Avermaet, 1982), to date there is no unified, overarching *Theory of SVO* that provides an extensive and coherent set of general hypotheses. Although empirical investigations of the SVO construct and its relationships with other variables comprise an active research area (e.g., Cornelissen, Dewitte, & Warlop, 2011; Fiedler, Glöckner, Nicklisch, & Dickert, 2013; Grund, Waloszek, & Helbing, 2013; Karagonlar & Kuhlman, 2013; Shelley, Page, & Kuhlman, 2010; Shelley, Page, Rives, Yeagley, & Kuhlman, 2009; Shug, Matsumoto, Horita, Yamagishi, & Bonnet, 2010; Van Doesum, Van Lange, & Van Lange, 2013), the endeavor to devise a unified SVO theory has not been undertaken so far because there is still ambiguity about how to measure this basic construct well.

We contend that the relationship between theory and measurement is bilateral and dynamic. Measurement methods influence how theories develop (or devolve as is the unfortunate case sometimes). As a continuous theoretical construct, SVO is conceptualized as a continuum that reflects the degree to which a DM will choose to sacrifice his or her own resources to benefit another. Furthermore, recent evidence strongly supports the continuous nature of SVO. For instance, Murphy, Ackermann, and Handgraaf (2011) showed that there is rich and reliable variance in people's concerns for others and that categorization destroys valuable information about real and persistent individual differences. Moreover, evidence shows that gradual differences in SVO are accompanied by gradual differences in the search behavior for information concerning outcomes for oneself and another person (Fiedler et al., 2013). These findings are incompatible with a categorical conceptualization of SVO. However, the continuous SVO construct has often been diminished and distorted by the stubborn use of categorical measurement methods that yield only nominal data. This low-resolution treatment of evidence has, in our opinion, constrained the way in which SVO has been considered, discussed, and developed. It has also limited the statistical power of studies looking for the interrelations between SVO and other factors, leading to Type II errors that may have undermined the evidence for the importance of nonselfish motivations in human decision making. The intertwined history of theory about SVO and the measurement of SVO provides an interesting example of a back and forth process between measurement

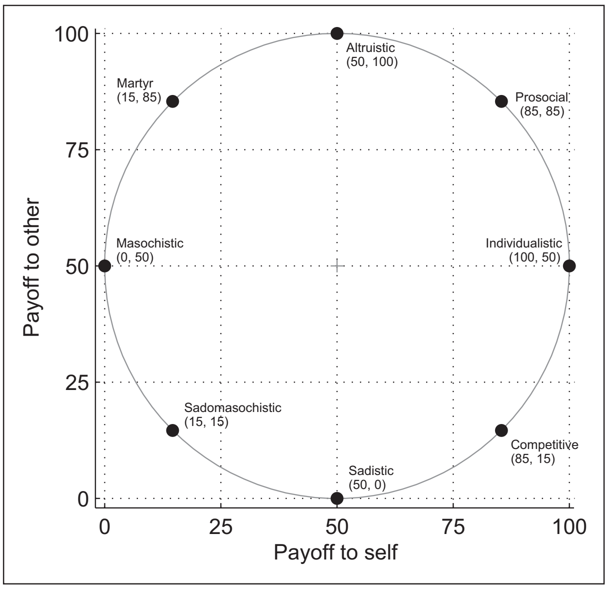

Figure 1. A graphical representation of the SVO framework.
Note. SVO = social value orientation.

methods and theory, and we hope to shed light on this reciprocal process by systematically delineating the development of different measurements of this important construct over time. In addition, we agree with Bogaert et al. (2008, p. 472) that, in light of the vast SVO literature, not much effort has been dedicated to a discussion and comparative evaluation of measurement methods for social preferences. The present article is therefore intended not only to bridge scientific disciplines concerned with the investigation of social preferences but also to fill a gap in the SVO literature and to foster theoretical as well as methodological developments from a broad perspective.

SVO Framework

SVO provides a framework for characterizing how a DM values joint outcomes (Griesinger & Livingston, 1973; Liebrand, 1984; McClintock, 1972; Messick & McClintock, 1968). A graphical representation of this framework, similar to the one provided by Liebrand (1984, p. 246), is depicted in Figure 1 and shows the motivations associated with different joint outcomes.

A point in the Cartesian plane corresponds to a specific joint outcome. The x-axis corresponds to the value of the DM's individual payoff. The y-axis corresponds to the other person's payoff. Although there are an infinite number of possible joint outcomes, those along the ring, intersecting one of the eight cardinal directions, provide clear and unique exemplars of different joint outcomes that correspond to idealized social preferences. For example, the unique point on the ring that maximizes individual earnings is at $x = 100$ and $y = 50$ (i.e., individualistic or narrow self-interest); the point on the ring that maximizes joint earnings is at $x = 85$ and $y = 85$ (i.e., prosocial). These points and their respective archetypical motivations are listed in Table 2. The values presented in Table 2 are consistent with Figure 1 and correspond to different idealized SVOs.[2]

One way to determine an individual's preferences across different joint distributions is to present a DM with a series of allocation decisions and ask him or her to select the most preferred apportionment (e.g., the binary choice presented in Table 1). These resource allocation decisions are sometimes referred to as *decomposed games* (Messick & McClintock, 1968; Pruitt, 1967). The term *decomposed games* emerged from seminal work that used simple two-player binary option games (e.g., the Prisoner's Dilemma) to study choice behavior in social contexts. One problem with using a proper game to study intrinsic preferences is that a game is by definition a strategic interaction. Games require DMs to choose not only according to their own preferences, but with those preferences conditioned on their beliefs of what the other player(s) prefer and will choose, knowing that the other player(s) are likely thinking the same thing, and so on. These decisions are complex in that they draw on personal preferences, beliefs about others' preferences, and beliefs about others' beliefs about preferences, and so on *ad infinitum*. As a method to measure preferences alone, the use of proper games is muddled and confounded by the strategic nature of the social interaction.

A solution to this measurement problem is to decouple preference considerations from strategic considerations. This simplified choice task is called a *decomposed game*. Although it is technically not a game, it does give an unconfounded measure of an individual's preferences for joint outcomes. For example, if a DM chooses Option 2 from the allocation choice presented in Table 1, we would infer that her motivation to maximize her own earnings is stronger than her motivation to maximize joint earnings; we would say she has a revealed preference consistent with an individualistic SVO.

Any individual choice task where a DM unilaterally makes a selection among different allocations of resources to himself and others is a decomposed game. Decomposed games have been used extensively to study social preferences (e.g., Kuhlman & Marshello, 1975a, 1975b; McClintock, Messick, Kuhlman, & Campos, 1973; Messick & McClintock, 1968; Van Lange et al., 1997). The dictator game is a decomposed game. For clarity, we refer to non-game contexts as *allocation decisions* to emphasize the non-strategic nature of the relevant choice tasks.

The framework presented in Figure 1 and Table 2 provides a taxonomy (Liebrand, 1984) of revealed social preferences but has several unusual categories that are rarely consistent with real DM's choices. Thus, researchers have focused their attention on a subset of social preferences in a particular region of the joint allocation plane. According to Messick and McClintock (1968) a person can fulfill one of

Table 2. The Archetypal Social Value Orientations.

Self	Other	Orientation	Inferred motivation	Weight on one's own outcome	Weight on other's outcome
85	85	Prosocial	Maximize the joint payoff or minimize the difference between payoffs	1	1
100	50	Individualistic (i.e., selfish, narrow self-interest)	Maximize the payoff to oneself	1	0
85	15	Competitive	Maximize the positive difference between the payoff for oneself and the payoff for the other	1	−1
50	0	Sadistic	Minimize the other's payoff	0	−1
15	15	Sadomasochistic	Minimize the joint payoff or minimize the difference between payoffs	−1	−1
0	50	Masochistic	Minimize the payoff to oneself	−1	0
15	85	Martyr	Maximize the negative difference between the other's payoff and the payoff for oneself	−1	1
50	100	Altruistic	Maximize the other's payoff	0	1

three different orientations. A person may be motivated to secure maximal resources for herself, indifferent to how much the other receives (i.e., maximizing own gain). Or a person may prefer to maximize the sum of the outcomes for self and other (i.e., maximizing joint gain). Or a person may prefer to maximize the difference between her own outcome and the other's outcome (maximizing relative gain). These three motivational orientations have longstanding labels in the psychology literature as individualistic, cooperative (i.e., prosocial), and competitive, respectively (Deutsch, 1960). The most common current measure of social preferences, the 9-Item Triple Dominance Scale (see Van Lange et al., 1997), uses the same three categories. There are a variety of other approaches to the measurement of social preferences that range from distinguishing between two categories (individualistic and prosocial) to differentiating among up to 10 categories as proposed by MacCrimmon and Messick (1976).

How Measures Shape Theory: The Case of SVO

Theory often precedes measurement. This is certainly true when something—whether an observable natural phenomenon, an inferred underlying force, or a hypothesized latent variable—is measured for the first time. The conceptualization of a measurement naturally requires the conceptualization of the object of measurement. However, once a measurement method exists and is used, the data it produces have an impact on subsequent theorizing about the object of measurement. There can be significant interdependencies between theory and measurement because refinements of theories are often driven by data, data depend in part on the measures used to obtain them, and the used measures depend on the theories originally proposed. In this vein, the relation between theory and measurement is not exclusively unidirectional or one-way dependent (see, for instance, Gigerenzer, 1991; Gigerenzer & Sturm, 2007). Furthermore, the instruments that we use to assess data can influence our thinking in a broader context (see Sturm & Ash, 2005). As Culkin (1967) noted, "We shape our tools and thereafter they shape us." Along these lines, the bidirectional relation between theory and measurement has shaped the conceptualization of the SVO construct in ways that impaired progress in measurement quality. In the following section, we elaborate on the remarkable anomaly that a valuable continuous theoretical construct has commonly been measured at the nominal scale level for decades.

As discussed earlier in this paper, the emergence of the SVO construct was triggered by the observation that most people often do not attempt to maximize the experimenter-defined payoff when interacting with others in strategic situations (McClintock & McNeel, 1966a, 1966b, 1966c, 1967; Messick & Thorngate, 1967). The pattern of results obtained in these studies led Messick and McClintock (1968) to the elemental assumption of three distinct goals that guide behavior in experimental games: maximize own gain (individualistic), maximize relative gain (competitive), and maximize joint gain (cooperative). Hence, an early notion of SVO was categorical. However, Messick and McClintock also tested whether a utility model[3] (see Messick & Thorngate, 1967) that is not restricted to categorical assumptions is useful for describing observed choice patterns. They found that a particular utility model poorly fit their data, abandoned it, and proposed a stochastic choice model instead. This stochastic model was based on the assumption that people are in one of the three suggested motivational states (or a state of indifference) at a particular point in time according to an individual probability distribution, and that their choices in a particular experimental game depend on the state adopted at the moment of choice. Therewith, a categorical conceptualization of social preferences won, and in hindsight this had a substantially negative impact on future SVO measurement.

A continuous conceptualization could have emerged however. The thinking behind the use of decomposed games for assessing SVO as originated from Messick and McClintock's seminal work has typically been the following: Particular discrete options in a decomposed game may be preferred given certain well-defined motivational goals. If an option is chosen by a DM, and this option dominates other available options with respect to a particular motivation, then the DM's motivation and preferences are revealed. The assumption of three different motivations was data driven but still an arbitrary taxonomy, and if the thinking had been more in line with a utility maximization approach, a continuous conceptualization of SVO would likely have emerged. The three motivational orientations can be represented as three parameterizations of the same utility function $U(x,y) = x + ay$, with $a = -1$ representing relative gain maximization, $a = 0$ representing own gain maximization, and $a = 1$ representing joint gain maximization. If such a representation had been salient to Messick and McClintock, it may have been obvious to assume a continuum for $a \in [-1,1]$ and therefore to conceptualize SVO as a continuous construct rather than a categorical typology $a \in \{-1,0,1\}$. Despite the fact that a continuous conceptualization of social preferences already existed in the late 1960s (see Sawyer, 1966), the influential work of Messick and McClintock forged how SVO has been theorized and commonly measured thereafter. Currently, the most commonly used SVO measures (the Triple-Dominance Measure and the Ring Measure) produce only categorical output consistent with how Messick and McClintock discussed SVO as informed by decomposed binary games.

We suggest that the persistence of a categorical conceptualization and operationalization of SVO has been promoted by measures commonly used to assess the SVO construct, and that in this way measurement methods have shaped theory. To elaborate on this claim, we focus on the development of the SVO concept and measures thereof following Messick and McClintock (1968). Two traditions of SVO conceptualization have evolved since then. One tradition followed the categorical approach described above, and the other tradition followed a utility model approach. In the utility model tradition, SVO was naturally conceptualized as a continuous, albeit not necessarily unidimensional, construct. The focus of research within this tradition was on postulating and testing different utility functions as representations of social preferences (see Grzelak, Iwinski, & Radzicki, 1977; Radzicki, 1976; Wyer, 1969). Given that parameterization is essential for testing utility models, and that parameters are usually not restricted to a limited set of values (such as only three points), a continuous theory of SVO is inherent to this approach. Building on the work of Messick and McClintock (1968) and Wyer (1969), Griesinger and Livingston (1973) showed how the two conceptualizations relate to each other by using a geometric approach to represent motivational orientations as vectors in the Cartesian plane with the x-axis corresponding to payoffs to oneself and the y-axis corresponding to payoffs to the other. This was a cornerstone in the history of SVO research because the geometric representation supported visualization of how different motives corresponded to particular combinations of weights in a simple utility function. DM's choices could be modeled as if they make tradeoffs between the payoff to the DM and the payoff to the other, given the utility function $U(x,y) = ax + by$ (see Table 2). Hence, Griesinger and Livingston's framework helped to clarify that SVO is a continuous construct.

However, this framework paradoxically promoted the categorical conceptualization of SVO thereafter because work building on Griesinger and Livingston's framework focused on the motivational categories rather than the underlying continuous motivations (see, for instance, MacCrimmon & Messick, 1976; Maki, Thorngate, & McClintock, 1979). Furthermore, the SVO measure that was constructed on the basis of the geometric framework and has become the second most commonly used instrument for assessing SVO, the Ring Measure (Liebrand, 1984; Liebrand & McClintock, 1988), has been used almost exclusively for categorizing subjects rather than eliciting continuous information.

We see a chain of reasoning that may be responsible for why the geometric framework led to a preference for simple categorical thinking. In the ring framework, the continuous SVO construct is two dimensional, one dimension referring to the weight a person attaches to his or her own outcomes, and the other referring to the weight a person attaches to the other's outcome. This is inconvenient because multidimensionality hinders the employment of simple statistical tests for evaluating individual differences in the construct and associations or interactions with other variables. However, the two dimensions can be translated into one in terms of an angle. This does not solve the problem because the interpretation of the angle is still not unidimensional. A statement, such as "the higher the angle, the higher the concern for others" does not hold when the full ring is considered. Augmentations in angular degrees beyond plus and minus 90° imply decreasing concerns for the other, while the opposite is true for angles within this range. Hence, the angle must be translated into a corresponding particular motivational category to be readily interpretable. This way of thinking, we speculate, is a reason why the categorical conceptualization has predominated in SVO research.

However, the problem of two-dimensionality could have been solved by simply disregarding one of the two dimensions, namely the dimension corresponding to the weight attached to the DM's own outcome, by assuming that this weight is equal to 1.0. This assumption appears justifiable given that we do not know of any evidence supporting the hypothesis that people generally ignore (pure altruism or pure aggression) their own payoffs or depreciate (martyrdom, masochism, or sadomasochism) their own outcomes. Evidence suggests that the utility function of own outcomes per se is monotonic increasing (Messick & Sentis, 1985); that is, everything else being equal, more of a good is strictly preferred to less of a good. Under this assumption, SVO becomes a unidimensional continuous construct defined as the weight that a person attaches to outcomes of others in relation to their own, represented by parameter a in the utility function $U(x,y) = x + ay$. This continuous, unidimensional conceptualization excludes the possibility of particular atypical motives (e.g., martyrdom, masochism, or sadomasochism), yet allows for aggression and altruism when letting a approach positive or negative infinity, respectively, and includes competition ($a = -1$), individualism ($a = 0$), and cooperation ($a = 1$) as particular prototypical cases.

Although such a continuous conceptualization is at least as old as the categorical one and was once applied for devising a measure of SVO (see Sawyer, 1966), it has apparently been abandoned for decades. Consequently, until the recent advent of a novel, continuous measure (Murphy et al., 2011), for about 30 years SVO has been assessed almost exclusively on the nominal scale. Researchers seemed to be aware that the construct is continuous in principle but chose to use categorical measures and then treat the categories as if they reflected the construct precisely, rather than as merely salient, but arbitrary, points on an underlying continuum.

Typically, SVO is defined as "stable preferences for certain patterns of outcomes for oneself and others," and researchers mention that "a variety of different SVOs can be distinguished from a theoretical point of view," but that a "three-category typology" would be applied in the present work.[4] It is usually hard to justify why a continuous construct is categorized or dichotomized in light of the obvious disadvantages of downsampling (see Cohen, 1983; Irwin & McClelland, 2003; MacCallum, Zhang, Preacher, & Rucker, 2002). For example, it would certainly be an odd idea to measure intelligence with an instrument that produced only a rough categorization of people into the three groups: "bright," "mediocre," and "dull." However, the same practice is commonly carried out when considering SVO, and this rough categorization reflects back and shapes theory. For a surprisingly long time it was a convention in psychology to dichotomize continuous variables for analyses (see MacCallum et al., 2002). The most often cited reasons for such a procedure include convenience and simplicity of ANOVA methods in contrast to multiple regression/correlation approaches. However, the adverse effects of discretizing continuous variables have been demonstrated clearly and repeatedly (e.g., Cohen, 1983; Fitzsimons, 2008; Irwin & McClelland, 2003; MacCallum et al., 2002; Royston, Altman, & Sauerbrei, 2006). Although the post hoc degradation of continuous data has been quite common, it apparently has been very uncommon to *measure* a construct at a lower level of measurement than its theory permits. In fact, it has been standard practice in psychology to measure constructs, including personality variables on continuous scales whenever possible.

In the case of SVO, methods too have shaped thinking in the same manner as in personality research, but in the opposite direction. The most commonly used SVO measures (the Triple-Dominance Measure and the Ring Measure) produce categorical output, and SVO researchers seem to have adopted, perhaps without deep reflection, a categorical conceptualization. This has resulted in the curious situation that, although continuous conceptualizations of individual difference variables have predominated in psychology, SVO has commonly been assessed and thought of as a nominal variable, even though shortly after its advent it was shown to be a continuous construct in principle by Griesinger and Livingston (1973). To our knowledge, a curious situation of this type is unique in psychology, but it may serve as an important reminder of the need to deliberate on the coherence between theory and measurement from time to time.

Existing Measurements of Social Preferences

In this section, existing approaches to the measurement of social preferences are described and discussed in approximate chronological order of publication. This general overview of the history of social preference measurements offers insight into how methods have changed and developed over time. In discussing approaches to social preference measurement, we focus on methods that assess people's preferences for certain allocations of resources. These preferences are revealed by eliciting people's judgments or choice behavior when they are presented with options containing different distributions of outcomes for themselves and for some other person. Questionnaires or Likert-type scale measures regarding verbally expressed altruistic or prosocial attitudes (e.g., Crandall, 1975; Rushton, Chrisjohn, & Fekken, 1981) are not discussed. The reason for this exclusion is twofold: Attitudinal measures are rarely used in SVO research, and we think that having people making decisions with real consequences is the best approach to measuring social preferences. For example, we consider the abandonment of real payoffs for the benefit (or detriment) of another person as stronger evidence for social preferences than the mere indication of an intention (i.e., cheap talk) to do so in a hypothetical situation or the expression of agreement with a qualitative statement. We think that the measurement of real behavior is superior to the measurement of intentions or attitudes given that the object of interest itself is behavior rather than inner processes (see also Baumeister, Vohs, & Funder, 2007). Hence, we only consider measures that allow subjects to make real decisions with real consequences.

To allow for comparative analyses of the different methods, the SVO measures are evaluated on the basis of a set of five predefined criteria. The first two criteria are standard psychometric ones, validity and reliability. However, we restrict ourselves to reporting only predictive validity, convergent validity among SVO measures, and test–retest reliability. The third criterion is output resolution for the reasons explicated earlier. The fourth criterion is efficiency in terms of the expenditure of time and effort associated with measurement completion and output evaluation. This criterion is included to give the reader who seeks the optimal measure for a particular research design information about pragmatic aspects. The fifth and final criterion involves particular advantages, that is, the useful features of a measure that are not commonly shared by other measures. At the end of this section, the reader is provided with a tabulation of the measures' scores per criterion. As these scores are based on judgment, they cannot be completely objective, and we do not purport that they are. In addition, it is not the purpose of this review to choose one method as best, but rather to perform a comparative evaluation to help interested researchers select the method that best suits a particular purpose. Furthermore, we provide a historical review on SVO measurement and a statement of how theory and measurement interact.

The Altruism Scale

Early efforts to quantify social preferences can be traced to sociology. Sawyer (1966) devised a method for assessing the degree of concern a DM has for the outcomes for himself and others. He called this method the *Altruism Scale*. However, Sawyer's method can assess a range of different orientations including prosocial, individualistic, and competitive motivations, and it would be more accurate to call it a *Social Preference Scale*. Within Sawyer's theoretical framework, the subjective attractiveness of a joint outcome was conceptualized as the linear combination $P_S + wP_O$, where P_S is the payoff for the self and P_O is the payoff for another person. The coefficient w represents how much weight a DM gives to the outcome for the other person, relative to his or her own outcome (the P_S term has an implied coefficient of 1.0). If a person is individualistic, and therefore interested in only his own welfare, the coefficient w would be zero. If a person is prosocial and cares about his own and the other person's welfare, w would be greater than zero. Conversely, if a person is competitive and tries to maximize the difference between his or her own and the other's payoff, w will be less than zero. Hence, the theoretical conceptualization of social preferences underlying the Altruism Scale is continuous.

The Altruism Scale described. Sawyer's method uses a conjoint measurement technique to estimate an individual's weighting (w) of outcomes for others. An index of altruism is computed based on the preference rankings of own/other outcome combinations. Specifically, participants (college students in this case) were asked to imagine that they would take a seminar with only one other fellow student and that each would receive a grade of A, B, or C at the end of the seminar. Participants were then asked to rank their preferences for the allocations of these grade combinations. After all nine of the rankings are made by a DM, the altruism index a can be calculated as follows:

$$a = \frac{\left(\sum \text{ranks in row C} - \sum \text{ranks in row A}\right)}{\left(\sum \text{ranks in column C} - \sum \text{ranks in column A}\right)}.$$

The index a is a manifest variable and serves as a proxy for the latent variable w. The numerator in computing a corresponds to how much a person cares about the outcome for the other person. If, for example, a person cares about the other's welfare, the DM will assign high ranks to the options where the other person receives A grades and low ranks to the outcomes where the other person receives C grades. In this case, the numerator is positive, indicating a prosocial orientation. Conversely, a negative result indicates competitiveness. A result of zero implies that the person is indifferent to the other student's grade. Sawyer used a second method to directly assess a by asking the DM to choose 1 out of 21 scale values, which corresponded to values of a ranging from −1 to +1 in increments of 0.1. The scale is anchored by statements at the values −1, −0.5, 0, +0.5, and +1. For example, the statement reflecting an a value of +1 indicates agreement with the following statement: "I am equally interested in how good his grade is and in how good my grade is," whereas the statement reflecting an a value of 0 indicates agreement with: "I am only interested in how good my grade is; how good or poor his grade is makes no difference to me."

According to Sawyer (1966), w ranges continuously from −1 to +1, that is, from perfectly competitive ($w = -1$) to perfectly prosocial ($w = +1$), with narrow self-interest ($w = 0$) at the midpoint. The coefficient a can take on values outside of this range given atypical motivations (e.g., masochistic). It is also worth noting that a is undefined (perfect altruism implies $w \to \infty$) if a DM provides a purely altruistic ranking (ranks that are consistent with maximizing the grade of the other student while being indifferent to the DM's own grade).

Discussion of the Altruism Scale. The Altruism Scale was an early innovation but has limitations as a measure of social preferences. First, the metric space of academic grades is not straightforward and is also not amenable to incentive compatible research (i.e., this protocol could not be ethically implemented). This particular choice context may force DMs to take a zero-sum mentality if they are accustomed to curved grading systems or are concerned with their overall class ranking. However, the method per se does not require using school grades as stimuli. Instead, any set of valuable goods containing three elements with transitive and strict preference ordering A > B > C could be used for eliciting preferences in principle. Hence, the method could be used for measuring social preferences of individuals who are not experienced with alphanumeric representations, such as young children. Nevertheless, there are other methods, such as utility measurement in general, or the Social Behavior Scale discussed later, that share this feature.

Second, a procedure for rank-ordering preferences that presents participants with all stimuli at the same time runs

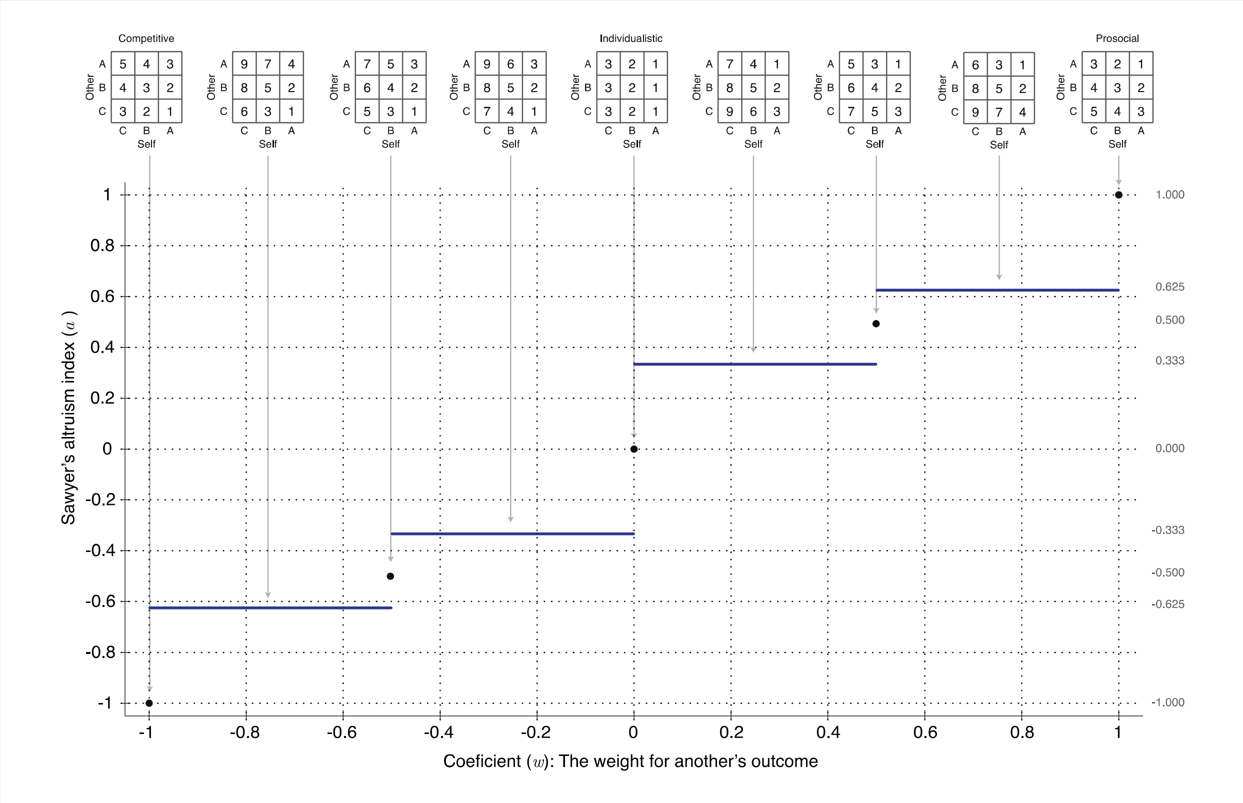

Figure 2. Sawyer's Altruism Scale, preference rankings, and the *a* index. Examples of different preference rankings (the 3 × 3 matrixes at the top of the figure) are displayed here. Furthermore, the relationship of these rankings with the underlying utility weight (*w*, shown on the *x*-axis) for another's outcome, and Sawyer's altruism index *a* are shown. The ranking of 1 indicates that this allocation of grades is the DM's most preferred joint outcome. As can be seen, ties in ranking outcomes are allowed. Particular rankings are consistent with underlying utility weights, and further each ranking matrix corresponds to an *a* index. Although *w* is continuous, the resulting altruism index *a* is a step function that can take on only one of nine values given *w* between −1 and 1 inclusive. Some rankings correspond to a single point of *w*, whereas other rankings are consistent with a range of *w* values.
Note. DM = decision maker.

the risk of yielding unreliable data because people are not very skilled at reliably ranking multiple items simultaneously (Saaty, 1980). Hence, as proposed by Sawyer himself, it would probably be beneficial to let participants make sequential pairwise comparisons to reduce complexity of the judgment task and yield more reliable rank orders. How one would elicit global rankings based on sequential pairwise rankings is not an issue that Sawyer addressed. However, because a rank ordering of nine outcomes can be produced relatively quickly and the computation of output variable a is trivial, the method is efficient with respect to time and effort.

Third, the Altruism Scale cannot differentiate between the prosocial motivations of joint gain maximization and inequality aversion. It also yields an undefined a index for a DM with a purely altruistic motivational orientation.

Fourth, the process of reducing a set of rank orderings into a single index may be problematic. Each a value at one of the three anchors (–1, 0, +1) has a clear interpretation, whereas values in between are not readily interpretable. Furthermore, the index a is an ordinal variable at best (Stevens, 1946, 1950) and is limited to nine particular values (see Figure 2). Moreover, the mapping from underlying utility w to the index a has a "many-to-one" structure which necessarily results in the loss of information.

With respect to psychometric properties of his measure, Sawyer (1966) reported weak validity and reliability. For example, the correlation between values obtained by the direct-scale estimation measure and the values obtained by the ranking method was only r = .32, challenging the measure's convergent validity. Sawyer reasoned that the discrepancy between the two measures was probably due to differences in task complexity and to multidimensionality in the rankings (i.e., the direct estimation measure promotes unidimensional judgments, whereas the conjoint method allows for more complicated preferences to manifest themselves).

Table 3. Triple-Dominance items.

	Prosocial option		Individualistic option		Competitive option	
Item	Self	Other	Self	Other	Self	Other
1	80	80	92	40	80	0
2	84	84	96	44	84	4
3	88	88	100	48	88	4
4	82	82	96	44	84	4
5	84	84	96	44	82	2
6	84	84	98	44	84	4
7	86	86	96	44	86	6
8	84	84	94	44	84	4
9	82	82	92	44	80	4

Note. These values have been standardized to range between 0 and 100 to facilitate comparison with the other measures presented in this paper. The original items ranged between 80 and 580 and were presented in the units of points (examples of the original form are shown in Van Lange, Otten, De Bruin, & Joireman, 1997; Van Lange, De Cremer, Van Dijk, & Van Vugt, 2007).

The 9-Item Triple-Dominance Measure

Decomposed games have their genesis from simple binary games that have been the "fruit flies" of interactive social decision research. In decomposed games, allocation choices can be constructed that differentiate between archetypal motivations. Historically, researchers have focused their attention on differentiating among the three most common archetypical social preferences (prosocial, individualistic, and competitive), ignoring other, less common motivations (Messick & McClintock, 1968).

For example, the allocation decision presented in Table 1 is designed to differentiate between prosocial and individualistic motivations. In Messick and McClintock's terminology, this type of item is referred to as a double-dominance item as either of the two options can dominate the other one with respect to a particular motivation. A prosocial person would choose Option A, and an individualist would choose Option B. However, a competitive type would also select Option B as it has a greater relative difference between the payoffs. So this particular allocation decision cannot differentiate between individualists and competitors as both types would choose the same option.

Two general approaches can solve this discrimination problem and distinguish between the three most common social preferences. First, a researcher can examine the complete set of choices made in a series of two-option, double dominance allocation decisions. The set of choices that pits each of the common social preferences against each of the other common social preference types is necessarily exhaustive and can isolate a DM's primary social motivation. This method would also identify an individual's least preferred social outcome, as well as yield a ranking of preference over the joint options. A second method to differentiate among the three most common social preferences uses a single allocation decision that has three particular options (as proposed by McClintock et al., 1973) such that each option dominates *both* the other two allocations with respect to one particular motivational orientation. These types of items have the property of triple dominance as they can differentiate between three SVOs. Triple-dominance items were adopted by Kuhlman and Marshello (1975a) who also used other decomposed game classes (double-dominance and single-dominance) for assessing social preferences. Building on this work, the 9-Item Triple-Dominance Measure of SVO (see Van Lange et al., 1997) has evolved to become a widely

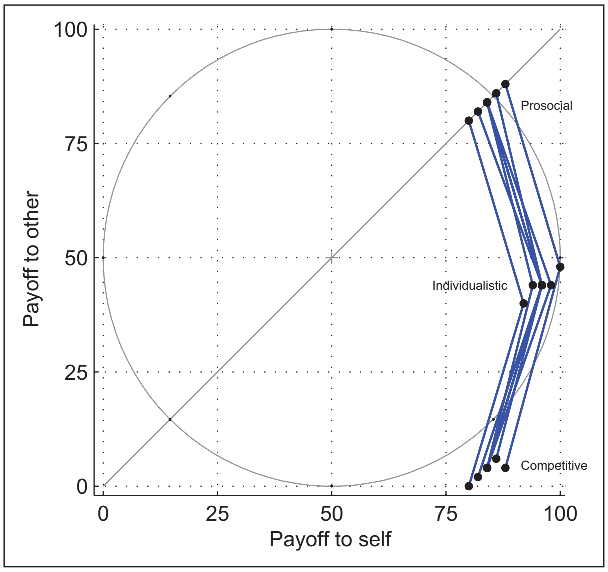

Figure 3. The 9-Item Triple-Dominance Measure. Each item is represented in the self-/other allocation plane as three points connected by a line. Notice the high degree of similarity among the nine items. It may be more accurate to say this is a scale with one item repeated nine times.

used measurement method for social preferences in social psychology (e.g., applied by Declerck & Bogaert, 2008; De Kwaadsteniet, Van Dijk, Wit, & De Cremer, 2006; Haruno & Frith, 2009; Joireman, Van Lange, & Van Vugt, 2004; Stouten, De Cremer, & Van Dijk, 2005; Utz, 2004; Utz, Ouwerkerk, & Van Lange, 2004; Van Den Bos, Van Dijk, Westenberg, Rombouts, & Crone, 2009; Van Dijk, De Cremer, & Handgraaf, 2004; Van Lange, Bekkers, Schuyt, & Van Vugt, 2007; Van Prooijen et al., 2008), in part due to its straightforward structure and ease of use (Van Lange, De Cremer, et al., 2007).

The 9-Item Triple-Dominance Measure described. The Triple-Dominance SVO items can be seen in Table 3 and Figure 3 as well. For each item, one allocation option is prosocial, one is individualistic, and one is competitive. These options are presented in different orders when implemented. The scoring rule for this scale is to count the number of individualistic, prosocial, and competitive options a DM selects. If a DM chooses six or more options from a particular category, then the DM is designated as being that type. If a DM does not choose at least six options from one category, then he or she is not categorized (e.g., McClintock & Allison, 1989; Platow, McClintock, & Liebrand, 1990; Van Lange & Kuhlman, 1994).

In other variants of the Triple-Dominance measure, only six items are used and participants are classified when at least five of the six choices are consistent with one of the three SVOs (e.g., Van Lange, 1999). However, the procedure of counting choices made in several decomposed games, and then classifying participants into SVO categories based on their choices, is a common evaluation technique. The 9-Item Triple-Dominance Measure uses this counting procedure for yielding scores as do other variants (e.g., Kuhlman & Marshello, 1975a, 1975b) of decomposed games.

Discussion of the 9-Item Triple-Dominance Measure. Although the 9-Item Triple-Dominance Measure is the most commonly used measure of SVO to date, it has some shortcomings. First, it can assign individuals to only one of three categories (prosocial, individualistic, or competitive) and provides no information beyond this basic categorization. This result is only at the nominal scale level (Stevens, 1946, 1950). However, social motivations are conceptualized as a continuous construct (Griesinger & Livingston, 1973; Wyer, 1969), and one practical result of forced categorization is low statistical power (Cohen, 1983). Attempts have been made to extract continuous information from a set of choices in the Triple-Dominance Measure. For example, the number of cooperative choices has been used as an SVO score (e.g., Hilbig & Zettler, 2009); the sum of payoffs to the other or to the DM has also been used as a rough index (see Sheldon, 1999).[5] These scoring methods are similar, as both are based on aggregating prosocial choices, with one method counting the number of prosocial choices and the other method summing the corresponding payoffs. However, we see several problems with procedures of this kind as they confuse the reliability of a preference with the magnitude of a preference. Although these two features may be related, they are not the same. Hence, an SVO score resulting from a counting procedure of these types of stimuli is confounded between *intensity* and *reliability*, and thus its meaning is ambiguous.

Consider, for instance, a comparison between a person A who chose the cooperative option eight times and a person B who chose it nine times in the Triple-Dominance Measure. How much weight do persons A and B attach to the outcomes of others in relation to their own? This question cannot be answered with these choice data. Furthermore, we cannot determine that B's weight is greater than A's. The 9-Item Triple-Dominance Measure is designed to detect whether a person's choice pattern is more consistent with a weight of 1, 0, or −1, and to categorize a person accordingly given a particular consistency criterion. A more fine-grained estimation of a person's preferences is not possible with this method. SVO scores resulting from a counting procedure thus purport informational richness that is not really there. Moreover, neither of the two counting procedures improves the Triple-Dominance Measure's test–retest reliability or convergent validity with other SVO measures.[6] Hence, for conceptual and empirical reasons, we are skeptical that useful continuous information can be extracted from the Triple-Dominance Measure.

Second, the Triple-Dominance Measure cannot discriminate between joint payoff maximization and inequality aversion. All of the prosocial options in this measure maximize joint outcomes and minimize inequality. Although these preferences may be related, they are not the same. There is evidence that persons classified as prosocial are concerned with the maximization of joint gain and equality in outcomes (Van Lange, 1999). However, there is conflicting evidence (Eek & Gärling, 2006) that prosocial DMs prefer equal outcomes over maximizing joint outcomes. It is not possible to address this issue with results from the Triple-Dominance Measure.

Third, the 9-Item Triple-Dominance Measure can only establish a DM's first preference, not his or her lesser preferences. Consider, for example, an individual who has a rank order of preferences as individualistic, prosocial, and competitive. Contrast this individual to someone else who has a rank order of preferences as individualistic, competitive, and then prosocial. These individuals may approach the world very differently. Furthermore, knowing an individual's least preferred allocation pattern would be informative, as an avoidant personality or *prevention focus* (Higgins, 1997) can serve as a motivational foundation. People who are strongly motivated to avoid their least preferred option, rather than focusing on their most favored option, would make different choices depending on the full ranking of their preferences. It is thus important to know not just a DM's most preferred outcome but also the entire rank ordering of her social preferences.

Fourth, three-option choice sets are more complicated than binary choices. The simplest choice is between two options and this setting requires the DM to make only one comparison in the process of making a decision. Increasing to three options requires the DM to make three comparisons. Moreover, the inclusion of one particularly unattractive option has been shown to have an effect on revealed preferences (Huber & Puto, 1983; Simonson, 1989) in surprising ways.

Fifth, it is a common practice to merge the two categories of individualistic and competitive orientations to form one group that is then compared with DMs in the prosocial category (see, for example, Cornelissen et al., 2011; De Kwaadsteniet et al., 2006; Joireman et al., 2004; Stouten et al., 2005; Utz, 2004; Van Den Bos et al., 2009; Van Prooijen et al., 2008). Obviously such a procrustean approach sacrifices valuable information. Collapsing across categories is not an intrinsic limitation of the Triple-Dominance Measure but rather a regrettable convention that has evolved and emerged when the number of participants per category is considered to be too low (see Van Lange & Liebrand, 1991) to support particular kinds of statistical analyses.

Sixth, offering a nearly identical choice nine times may induce participants to vary their responses in unexpected ways. In some cases, this variation may be a reflection of their honest preferences rather than inconsistency. For example, we had one participant from pretesting explain during debriefing that he answered about half of the items individualistically and the other half prosocially. His goal, he explained, was to be nice, but not *too nice*. This participant treated the scale holistically and provided a set of answers that, when considered in total, were sensible. But this sensible set of responses would have resulted in an uncategorizable result using the standard scoring rule. In other cases, participants may become bored or suspicious of answering the same item repeatedly and thus vary their answers. Ironically, the high degree of redundancy in the Triple-Dominance Measure may undermine its ability to classify participants. For example, in the study conducted by Kuhlman and Marshello (1975a), the percentage of unclassifiable participants was 25% (42 out of 167); Kuhlman, Brown, and Teta (1992) reported 29.3% (41 out of 140) unclassifiable participants; and Sheldon (1999), who made use of the Kuhlman and Teta measure, even applied an alternative, and problematic, scoring method after having lost 27% (25 out of 90) of the participants for analysis because they were not classifiable.

The greatest advantage of the Triple-Dominance Measure is probably its high efficiency. The measure focuses on only the three most commonly observed archetypal SVOs and can be completed in less than about 5 min. Furthermore, data evaluation is straightforward and neither computationally demanding nor time consuming. Due to these features, the method can be regarded as a quick and simple way to assess SVO.

With respect to the psychometric properties of the measure, results indicate medium quality. The measure shows satisfying test–retest reliability. Usually, about 70% to 75% of subjects are categorized into the same SVO category at two different points in time (see, for instance, Murphy et al., 2011; Van Lange & Semin-Goossens, 1998). In terms of convergent validity with other SVO measures, results are scarce and inconsistent. While Murphy et al. (2011) reported satisfying convergent validity (in terms of categorical agreement with the Ring Measure [67%] and the Slider Measure [74%]), Parks (1994) found no association between a variant of the Triple-Dominance Measure and the Regression and Clustering approach (discussed later in this paper) by Knight and Dubro (1984). Data on the predictive validity of the 9-Item Triple Dominance Measure are plentiful and usually show small to medium effect sizes in a variety of domains (see, for instance, De Cremer & Van Lange, 2001; Van Lange, Bekkers, et al., 2007; Van Vugt, Van Lange, & Meertens, 1996), although counterexamples of low predictive validity exist as well (see Joireman et al., 2004; Parks, 1994). In sum, we regard the psychometric properties of the Triple-Dominance Measure as sufficiently strong but with room for improvement (see also Au & Kwong, 2004; Bogaert et al., 2008).

Rank Correlation Technique With Decomposed Games

Another measurement technique that relies on decomposed games for assessing SVO was introduced by Iedema and Poppe (1994a, 1994b, 1995). Iedema and Poppe presented DMs with pairwise comparisons of eight (or nine) different own/other payoff allocations, resulting in a total of 28 (or 36, respectively) allocation decisions. Then ranks were assigned to the payoff allocations for each participant according to how often each of these alternatives had been selected. Prior to this assessment, Iedema and Poppe had compiled ideal rank orders of the alternatives with respect to six idealized social orientations (individualism, altruism, equality, cooperation, competition, and maximin). The assessed rank orders were then correlated with each of the six ideal rank orders for each participant, yielding six correlation coefficients per participant, each of which indicated the relation between the participant's rank order and the corresponding ideal rank orders of the six social orientations. These coefficients were then transformed into Fisher z-scores ranging from −3 to +3, and participants were classified to a particular SVO category matching their highest z-score, provided that this score was greater than a predetermined threshold. In one instance, a threshold of 0.55 (which corresponds to a correlation coefficient of 0.50; Iedema & Poppe, 1994a, 1994b) was used. In another instance, a threshold of 0.881 (corresponding to a correlation of 0.707, reflecting the threshold of 50% explained variance; Iedema & Poppe, 1995) was required.

Iedema and Poppe's rank correlation method allows for the detection of particular motives that originally were not part of the SVO concept as proposed by Griesinger and Livingston (1973) but were introduced later by MacCrimmon and Messick (1976), namely inequality aversion (or egalitarianism) and the maximin orientation. However, other measures, such as Schulz and May's Sphere Measure (to be discussed later) assess these motives as well. One advantage of the rank correlation measure is that a person's full rank order of preferences can be estimated, as *z*-scores are obtained for all of the six predefined social motives, and can thus be compared with each other. Nevertheless, the method is not very efficient. It uses more than three times as many items as the Triple-Dominance Measure for assessing only twice as many motivational orientations, yet the output is still categorical. Moreover, the data evaluation procedure for computing the categorical output is fairly complicated. In addition, to our knowledge, there are no data available on the method's psychometric properties, which preclude a direct comparison with other methods in terms of measurement quality.

Utility Measurement

Utility measurement refers to the systematic estimation and mapping of how subjectively valuable payoffs, goods, or outcomes are to a DM. Utility is an abstract construct that is inferred from the revealed preferences of DMs as they make choices among available and feasible alternatives. These alternatives can include "bundled outcomes," sets of discrete goods that are considered and evaluated as a set. Obviously, the utility of these bundled outcomes results from their constituent parts. However, the way a DM integrates information about the items and makes tradeoffs between them may not be obvious. Early studies of these kinds of choices by Thurstone (1931) involved participants making paired comparisons between sets of goods (e.g., [2 hats, 4 pairs of shoes] vs. [3 hats, *X* pairs of shoes]) where *X* was varied systematically by the experimenter. This approach yielded an estimated value of *X* where a DM was indifferent between the sets. Given fungibility and an indifference point, the relative contribution of the discrete items to the bundle's overall utility could be inferred, and a personal exchange rate could be estimated between disparate objects.

With respect to social preferences, joint allocations are viewed as *bundled outcomes* that have at least two distinct potential outcomes for a DM: the payoff for the DM and the payoff for another person. Individual differences emerge because different people may place different subjective value on these sources of utility and make different subjective tradeoffs when evaluating the bundle as a whole. Although the notion of utility is most closely associated with microeconomics, this framework is consistent with functional measurement (Anderson, 1970), specifically in the context of information integration theory (Anderson, 1968). Having people make choices among options, thus revealing their preferences and ultimately estimating their subjective utility, also has a long history in psychology, including Thurstone (1931), Luce and Raiffa (1957), and Kahneman and Tversky (1979).

Utility measurement described. The approach of using utility estimation in the context of own-other-outcome bundles is not a new idea. Edgeworth conjectured that between pure selfishness and pure prosociality (or in his words—*Pure Universalistic*) there exists a wide range of in-between orientations. He wrote:

> For between the two extremes Pure Egoistic and Pure Universalistic there may be an indefinite number of impure methods; wherein the happiness of others as compared by the agent (in a calm moment) with his own, neither counts for nothing, nor yet "counts for one," but counts for a fraction. (Edgeworth, 1881, p. 16)

From this statement, one can see that the idea that utility in social contexts is affected not only by one's own welfare, but also by the welfare of others, is not new. Edgeworth postulated that the welfare of others does not have the same impact on one's happiness as one's own welfare but instead has some lesser fraction of that impact. The magnitude of this fraction is operationally an index of prosociality. The coefficients or weights attached to the outcomes of others as specified in utility functions is a modern interpretation of what Edgeworth discussed when using the term *fraction* in this context. Narrow self-interest is just the special case where an individual's coefficient for other's outcomes is equal to exactly 0.

The use of utility functions for representing social preferences is standard in economics, and a multitude of other-regarding utility models have been posited (e.g., Bolton & Ockenfels, 2000; Charness & Rabin, 2002; Cox, Friedman, & Gjerstad, 2007; Dufwenberg & Kirchsteiger, 2004; Falk & Fischbacher, 2006; Fehr & Schmidt, 1999; Geanakoplos, Pearce, & Stacchetti, 1989; Levine, 1998; Loewenstein, Bazerman, & Thompson, 1989; Rabin, 1993). However, in economic research, model parameters are estimated or inferred mainly from behavior in strategic situations. This approach is problematic because behavior in these situations is a function of preferences and beliefs, and distinguishing between these two factors *ex post* is impossible. Decomposed game techniques were introduced precisely to overcome this problem by eliminating the possibility of strategic considerations as codeterminants of behavior in interdependent situations. Nonstrategic own/other payoff allocation tasks, such as the Dictator Game, have also been used for studying social preferences in economics though. For example, by using a set of joint allocation tasks, Andreoni and Miller (2002) showed that the vast majority of people's choice patterns can in principle be represented by a utility function that incorporates payoffs for others, and thus social preferences are rationalizable in a rigorous axiomatic framework.[7]

In psychology, Wyer (1969) used the framework of joint utility evaluations to successfully predict choice behavior in particular classes of strategic games. His approach transformed preferences for outcome allocations into utilities. Wyer, as well as Griesinger and Livingston (1973), modeled the utility of joint allocations as a linear combination of the weighted outcomes for the self and for another. Wyer used a utility function with the form

$$u(P_S, P_O) = (\mathrm{I} \cdot \mathrm{w}_1 \cdot P_S) + ((1 - \mathrm{I}) \cdot \mathrm{w}_2 \cdot P_S) + (w_3 \cdot P_O),$$

where P_S represents the outcome for self, P_O represents the outcome for other, coefficients $w_{1,2,3}$ represent weights of the respective outcomes, and I is an indicator function which yields the value of 1 if $P_S > 0$ and 0 if $P_S \leq 0$. In his experiment, Wyer (1969) used a 21-point rating scale to assess the desirability of allocation outcomes. Participants were asked how much they would like, for example, a distribution of 2 points for themselves and −3 points for another. The scale ranged from between −10 and +10 in interval steps. These desirability ratings were then inserted into the above formula as an estimated utility value, conditional on that particular allocation (in this example $P_S = 2$ and $P_O = -3$). After a series of ratings were obtained from a research participant, the weights $w_{1,2,3}$ were estimated by ordinary least-squares fitting.

Different sets of weights indicate different social orientations. Considering instances of positive outcomes, a person with an individualistic orientation would have a high positive w_1 weighting and a w_3 weighting close to zero. Prosocial individuals would have positive values for w_1 and w_3 that are similar in magnitude. Wyer (1969) showed that the competitive orientation would be reflected by a positive w_1 and a negative w_3.

More complex utility models have been posited. For example, second-order polynomials have been used to account for joint utilities. Radzicki (1976) used a conjoint measurement technique to identify a best fitting utility function. Participants were asked to rank 25 joint allocations from the most preferred to the least preferred distributions. These rankings were then analyzed and linear programming methods were used to determine the form of the utility function that fit the particular rankings best. This method yielded a particular utility function, along with weighting coefficients, for each of the DMs. Radzicki found that simple linear functions fit 41% of the participants' rankings best, whereas for 8% of the participants' rankings, none of the considered functions fit the ranking data sufficiently. In many cases though, nonlinear functions exhibited a significantly better fit to the data than simple linear models. For example, for people with nonlinear joint preferences who were concerned with equality in outcomes, the six parameter function that best fit was of the form

$$u(P_S, P_O) = \mathrm{a} \cdot P_S + \mathrm{b} \cdot P_O + \mathrm{c} \cdot {P_S}^2 + \mathrm{d} \cdot {P_O}^2 + \mathrm{e} \cdot (\left|P_S - P_O\right|^{\mathrm{f}}),$$

where $0 \leq f \leq 1$ and the other parameters (i.e., a to e) are unrestricted. Although the simplicity of linear models is convenient and in many cases is sufficient to describe choice behavior with respect to joint allocations, nonlinear models allow for more sophisticated descriptions of choice behavior and are able to account for more complicated patterns in data. Nonlinear approaches are suggested by MacCrimmon and Messick (1976), and Wyer (1969) noted that nonlinear relations between given outcomes and their utilities are possible, if not probable, when payoff amounts exceed a certain range of values under consideration. For example, the increase of a payoff amount from one dollar to two dollars is probably not equally valued as an increase from 500 dollars to 501 dollars with respect to utility. From this point of view, nonlinear models are justifiable when the values of outcomes presented to DMs vary widely in the amounts under consideration.

Discussion of utility measurements. As McClintock and Van Avermaet (1982) noted, the approach of using utility functions for the evaluation of social preferences as performed by Wyer (1969, 1971), Radzicki (1976), and others (e.g., Loewenstein et al., 1989; Messick & Sentis, 1985) is focused on building simple models that adequately describe the assumed combinatory rules underlying preferences within the framework of own-other outcome allocations and theoretically allows for an infinite number of possible SVOs. Therefore, these models do not state particular SVOs *a priori* but rather infer SVO from the best fitting parameters in a particular joint utility function. By contrast, methods following the lines of Messick and McClintock (1968), such as the Triple-Dominance Measure or decomposed games in general, including the Ring Measure, are more concerned with the "substantive nature" (McClintock & Van Avermaet, 1982, p. 59) of SVO. That is, the existence of a number of predefined SVO categories or types is assumed *a priori*, and the emphasis is placed on making assignments by observing DM's choices between two or more outcome allocations that indicate particular archetypical social orientations.

Nevertheless, the use of utility measurement for assessing SVO has certain drawbacks. First, when SVOs for different people are expressed using different functional forms, each representation potentially containing a different number of parameters, it is difficult to compare or aggregate results. For example, Radzicki's (1976) method is likely too flexible to be useful and certainly overfits rating data that contain measurement error. However, the problem of interpersonal comparability can be solved by using only one functional form for all model fitting. In this way, all subjects can be described in terms of individual best fitting values of the same model parameters, which then allows for interpersonal comparisons.

Second, DMs are not making choices in the utility estimation methods described above but rather judging the attractiveness of different hypothetical allocations. Rating procedures, such as the one applied by Wyer (1969), make strong linear assumptions of the response scale that are likely not met, especially given the scale's expanse (a 21-point rating scale). Eliciting judgments rather than choices introduces a level of abstraction that does not offer clear benefits. Moreover, inducing participants to report their preferences honestly, by incentive compatible research methods, is not easily accommodated with judgment tasks like the ones suggested above. However, this limitation is not inherent to the method of utility measurement in general.

Given that utility measurement is a whole methodology class that is not restricted to the assessment of social preferences, rather than a particular SVO measurement instrument, its evaluation on the basis of our set of criteria is complicated. The criterion of psychometric properties, in particular, is not readily applicable here. However, the approach can be partially evaluated in terms of the remaining three criteria. With respect to output resolution, these methods facilitate continuous, and even multidimensional, data. Nevertheless, the generation of this high resolution output is costly. Model fitting procedures require the use of sophisticated quantitative tools, and their application can be quite demanding and time consuming for researchers. Whether the method can be regarded as more or less efficient depends on its purpose. Although it can be considered as highly efficient when used for the purpose of investigating the nature of social preferences itself, it is quite inefficient when SVO is assessed in an experiment to explore its simple linear relationship with other variables. The greatest advantage of utility measurement is flexibility, which is unique in comparison with the other methods discussed in this paper. All that the method requires is data establishing preference orderings: choice data, rating data, or data on comparative judgments/preferences. Hence, the data could be based on option sets involving gains and losses, or tangible objects rather than money. Due to this flexibility, the method can be used in virtually any experimental context.

Indifference curves: Measuring SVO graphically. In addition to utility functions, indifference curves can also be used to represent different preferences for joint outcomes. Consider a set of curves plotted on a two-dimensional plane defined by the payoff to the DM on the x-axis and payoff to another person on the y-axis. Radzicki (1976) depicted indifference curves resulting from a utility function corresponding to the best fit of participants' rating data.

Another innovative approach along these lines was developed by Harrison (1998) who conducted an "indifference curve experiment" based on a procedure described by economists MacCrimmon and Toda (1969) and similar to the approach by Thurstone (1931). Harrison requested participants to make several pairwise choices between various joint allocations of money. For example, participants chose between an allocation of \$10 to themselves and \$8 to another, or \$17 for themselves and \$15 to another.

The first optional distribution was referred to as the "reference allocation" which was always the same bundle of joint outcomes for a set of choices. After multiple choices are made by a DM, the researcher can infer an indifference curve as the boundary between those allocations that were preferred over those allocations that were not preferred (see Figure 4).

By repeating this procedure and using different reference allocation points, an arbitrary number of indifference curves can be discerned, resulting in a contour map consistent with a DM's SVO. This measurement procedure can be conducted to an arbitrary level of precision, depending on the number of choice sets presented to a DM. The example depicted in Figure 4 shows how one indifference curve can be inferred from 18 distinct pairwise choices; these are stimuli from Harrison (1998).

One advantage of such a procedure is that participants are presented with pairwise comparisons rather than multiple comparisons or abstract rating scales. Furthermore, no *a priori* assumption about the number of predefined SVOs is needed, while the indifference curve patterns resulting from the procedure allow for interpretations regarding the extent to which they are consistent with respective SVOs. This method can also quickly identify intransitive choice sets or random responding from particular participants, as no indifference curve can be inferred from their allocation decisions. It can also readily accommodate incentive compatible choices.

This approach, however, also has some limitations. First, the resulting indifference curves are identified heuristically and not analytically. Specifically, a curve is "eye-balled" into place to divide the chosen points from the nonchosen points. An indeterminate number of bivariate functions could yield a curve that separates the chosen options from the nonchosen options while intersecting the reference allocation. Identifying the best fitting curve is impossible given the low resolution of the choice data, and the heuristic method of curve fitting does not lend itself to parameterization. To address this issue, a researcher could specify a functional form for the joint utility equation (similar to Radzicki, 1976) and then roughly estimate an underlying utility function with parameters that are consistent with the choices. Although this approach would quantify the heuristic indifference curve to some degree, the resulting joint utility function and parameters are not easily comparable between participants given the variety of functional forms (e.g., different kinds of mathematical equations representing different models) that may be used to summarize the underlying set of binary choices. Another shortcoming of this approach is the relatively large number of choices a DM is required to make to infer one indifference curve. In the example shown in Figure 4, which is based on stimuli from Harrison (1998), 18 binary choices

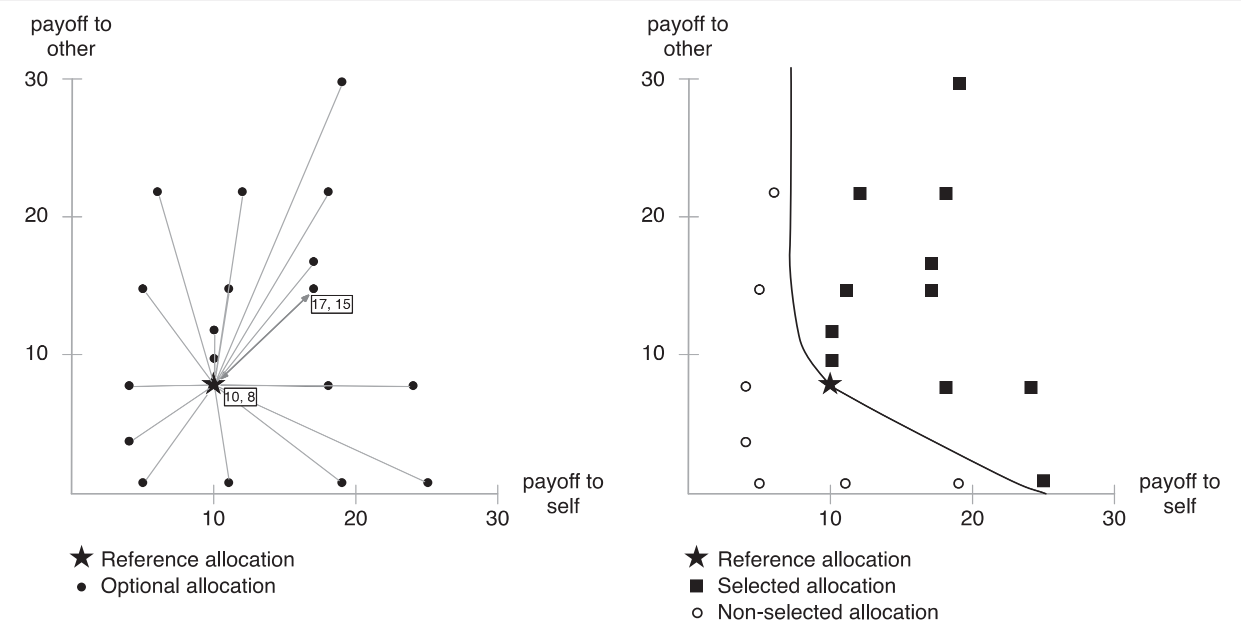

Figure 4. An example of the indifference curve method. The left panel shows 18 pairs of potential allocation choices that a participant would consider. Each of them has in common the Reference Allocation. Each of the optional allocations is either chosen over the Reference Allocation or not. The resulting pattern of preferred options can be used to identify an indifference curve that by definition intersects the Reference Allocation point.

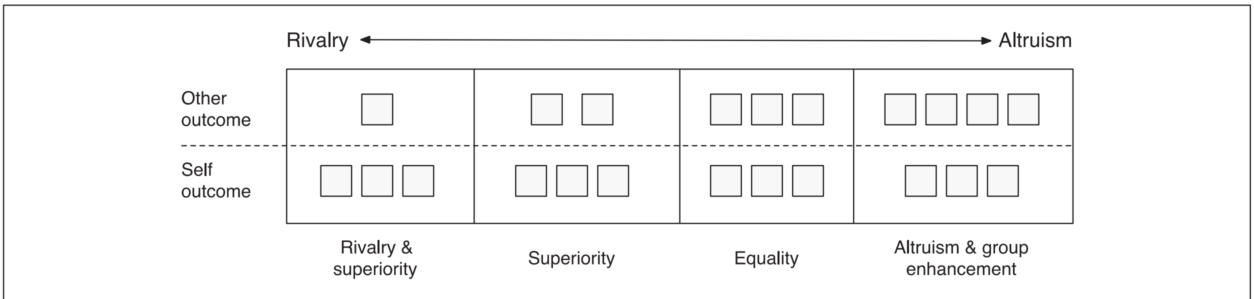

Figure 5. The Social Behavior Scale showing potential distributions of valuable items between the DM and some other person.
Note. DM = decision maker.

were used to approximate just one indifference curve. With respect to our criteria, the indifference curve approach has the same properties as utility measurement in general.

The Social Behavior Scale

The Social Behavior Scale comes from developmental psychology and was devised as a measure that controls for individualism by keeping the payoff to the DM constant and varying only the payoff to the other. Consequently, DMs are not given the opportunity to maximize their own gain by choosing a particular alternative but have control only over the outcome for another.

The Social Behavior Scale described. The Social Behavior Scale is a choice task with four alternatives as shown in Figure 5. The alternatives are rivalry and superiority; superiority; equality; and altruism and group enhancement. Outcomes for self and other are depicted as small squares and labeled as valuable "chips." Participants were asked to choose one of the four alternatives, yielding a distribution of the chips. This measure was devised by Knight and Kagan (1977) in an effort to study the social behavior of young children from different ethnic groups. In their experimental study, children were told that the more chips they acquired, the more toys they would receive. This "currency" is easily comprehensible and can be presented without any numerical abstraction, ideal for use with children, especially when there may be differences with respect to their formal educational experience.

Discussion of the Social Behavior Scale. As a result of its properties, especially with regard to assessing individualistic orientations, the Social Behavior Scale is too restricted to be a generally useful measure of SVO. Of course, one can imagine an alternative form of the Social Behavior Scale, where individualism is not strictly controlled. In fact, a variant of the Social Behavior Scale, the Social Orientation Choice Card, with a classical triple-dominance structure, is available (Knight, 1981). We can imagine numerous alternative forms of that kind that present allocation decisions across a range of outcomes with simplified stimuli. Such methods can be advantageous when conducting studies with children or populations not accustomed to quantified information, as was the case in Knight and Kagan's research. Because the Social Behavior Scale can be regarded as a nonmonetary payoff variant of a decomposed game measure, it receives a similar evaluation as the Triple-Dominance Measure with respect to our criteria. The measure consists of only one item that subjects answer several times, and the subjects are categorized according to their modal choice. Hence, the method is efficient in terms of time required for completion and output computation. However, output is categorical. To date, the measure has been used exclusively to study the development of SVO in children, so no data on its predictive validity with respect to other variables are available. However, some data exist regarding the measure's convergent validity with the Regression and Clustering approach (see Knight & Dubro, 1984, discussed later in this paper) showing 66.7% categorical agreement. In addition, Knight and Kagan (1977) reported data hinting at the measure's test–retest reliability (a correlation of 0.72 between the total number of chips allocated to other at two points in time separated by 2–5 days).[8] As discussed earlier in this paper, the scoring rule of counting the payoffs allocated to the other is problematic and complicates interpretation of results. From the data available, we conclude that the measure's psychometric properties are marginally satisfactory at best.

The Ring Measure

The Ring Measure is a method from social psychology that uses a series of dichotomous allocation decisions and derives an SVO score from the combined results of the choices. This aggregate value is then used to assign the participant to one of the archetypical SVO categories if possible. The method is based on the notion that joint payoffs can be represented on a Cartesian coordinate system where payoffs to the DM are represented on the x-axis and payoffs to another person are represented on the y-axis (see Figure 1). This idea is consistent with the geometrical model devised by Griesinger and Livingston (1973), who conceptualized a person's SVO as a vector with a certain direction and magnitude in the joint payoff plane. The utility of a particular payoff allocation can then be expressed as the scalar product of the motivational vector with the vector of the given choice, or in other words, the projection of the given choice vector on the motivational vector. Consequently, it is expected that a person will always choose the payoff allocation with the greatest projection on his or her motivational vector. Furthermore, the angle of the motivational vector indicates a person's social preferences. For example, a motivational vector at the angle of $\theta_M = 45°$ represents a prosocial orientation, whereas an individualistic motivation is represented by a vector at $\theta_M = 0°$ (see Figure 1). Following this conceptualization, Liebrand (1984) developed the Ring Measure as a novel method for categorizing participants into the archetypical SVO classes (see Table 2).

The Ring Measure described. The Ring Measure presents DMs with a set of N dichotomous allocation decisions that are defined by N equidistant points on a circle centered at the Cartesian origin ($x = 0$, $y = 0$). Each pair of adjacent points (defining a chord on the circle) serves as the two distribution options, and the DM makes a series of choices over these different allocations. Researchers have set the value of N at both 24 (Liebrand & McClintock, 1988) and 16 (Liebrand, 1984).[9] Generally, the Ring Measure has been implemented by a defining center point at (0, 0), yielding positive and negative allocation values for the DM and the other. However, to facilitate comparison with other measurement methods presented in this paper, the distribution values have been standardized to range between 0 and 100 (see Figure 6). This is equivalent to defining a ring with a center at (50, 50) and a radius of 50 units.

After a research participant has made N allocation choices, a vector is computed by adding the chosen options together, thus yielding two numbers (the sum of money the participant allocated to self, and the sum of money the participant allocated to the other person). The resulting point can be interpreted as a vector (using the center point of the ring as its origin). The angle of this vector corresponds to a person's SVO and can be computed by

$$\text{SVO Ring } \theta = \arctan\left(\frac{\sum P_O}{\sum P_S}\right)$$

where $\sum P_O$ is the sum of payoffs selected for the other person and $\sum P_S$ is the sum of payoffs allocated to the self. The length of the vector from the center of the ring indicates the internal consistency of the DM's allocation decisions. If a person makes inconsistent choices, the result is a shorter vector. Perfectly consistent choice sets have the property of having one option being chosen twice (the most preferred distribution in the whole set), one option never being chosen (the least preferred allocation), and the remaining allocations being chosen exactly once (see Figure 6 for an example of a perfectly consistent choice pattern). The vector resulting from a perfectly consistent set of choices will have a length equal

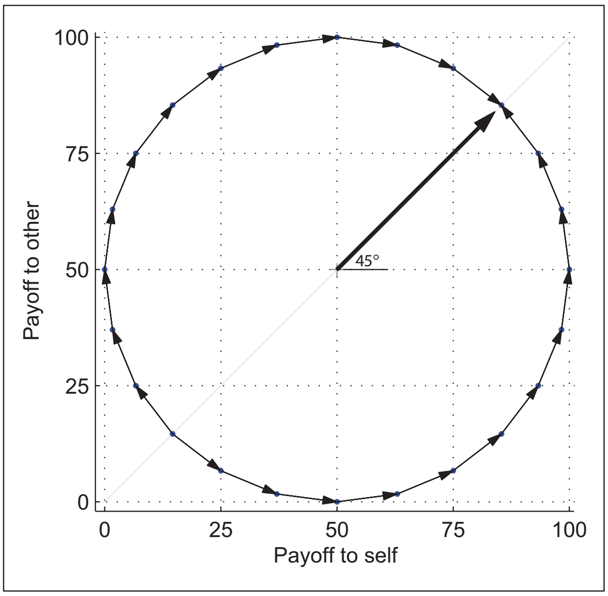

Figure 6. Here, the 24 allocation choices on a Ring Measure are represented graphically. The smaller arrows correspond to a set of hypothetical choices by a prosocial DM and the points to the joint allocation options. For each set of options, the DM selected the option that maximized joint gain, as indicated by an arrow pointing toward the more preferred joint allocation. This pattern of results reveals an underlying preference vector that is represented by the large arrow. Its angle (in this case +45°) serves as an elegant summary of the DM's social preferences as revealed by her choices of resource allocations.
Note. DM = decision maker.

to twice the radius of the circle used to generate the items, conditional that the center of the circle is fixed at the Cartesian origin. Because of the structure of items in a Ring Measure, the more rigorous property of preference *transitivity* can rarely be evaluated for a participant's set of choices because there is only one possible Hamiltonian cycle in the set of items. Only the weaker condition of *consistency* with a single underlying motivational vector can be evaluated with any fidelity.

When the angle of a person's vector is determined, that person is assigned to one of the eight SVO categories listed in Table 2. To prevent invalid classifications, DMs are typically classified only if the consistency of their choices is at least 60%. However, there is some variability regarding the standards for establishing a classification. For example, some classifications are made with a 50% consistency level (e.g., Van Lange, 1999) or, in other cases, only if a vector is not shorter than a quarter (e.g., McClintock & Liebrand, 1988) or even a fifth (e.g., Dehue, McClintock, & Liebrand, 1993) of the maximum possible vector length.

Discussion of the Ring Measure. On first consideration, the Ring Measure's agnostic method of defining items evenly over the complete circle may appear to be a sensible approach. However, overwhelming evidence demonstrates that SVOs are not uniformly distributed among people and that the vast majority of DMs do not attach negative weight to their own payoffs. Therefore, using items uniformly from the whole space of possible preferences is inefficient. The structure of the Ring Measure assigns equal value to all of the items, including the items "Is a person more prosocial or more individualistic?" and "Is a person more of a martyr or more of a masochist?" Clearly the first question is more useful in trying to understand the motivations of typical DMs. But, because of its blanket approach, the majority of items contained in the Ring Measure provide no useful information about the motivations of the respondent. The only items that offer useful diagnostic information are those with slopes that are nearly perpendicular to the underlying motivational vector of the DM. This agnostic approach results in a highly inefficient research tool.

Second, the Ring Measure fails to classify a significant number of participants due to inconsistent choice behavior. In their analysis of several studies that applied the Ring Measure, Au and Kwong (2004) reported up to 20% unclassifiable participants, and the percentage of unclassifiable participants across two experiments by Liebrand (1984) was 15%. In evaluating these percentages, one has to consider that Liebrand used a 60% consistency criterion, whereas in at least some studies analyzed by Au and Kwong (2004), a 50% consistency criterion was chosen (e.g., Van Lange, 1999). Part of this inconsistency could be the result of asking for people's preferences across such a wide range of potential allocations and the DMs having only weak preferences about some. For example, we have evidence that people show less consistent choice behavior in the items located in Quadrants 2 and 3 of the Cartesian plane (i.e., the left side of the ring) compared with items located in Quadrants 1 and 4 (i.e., the right side of the ring). Using the ratio $(\sum P_O)/(\sum P_S)$ as the unit of analysis, we found a test–retest reliability of 0.617 for the left half of the ring compared with 0.702 for the right half of the ring.[10] These results indicate that the Ring Measure could be improved by cutting it in half with a vertical line, and using only the items located in Quadrants 1 and 4 of the Cartesian plane. The resulting Half-Ring Measure has been used (e.g., Balliet, 2007; Joireman, 1996) but with only limited success.

Third, inequality aversion would manifest as inconsistency in the Ring Measure. The 45° diagonal line from the origin intersects the ring in two places; the point in the upper right part of the ring corresponds to minimizing inequality as well as maximizing joint gain, whereas the point in the lower left part corresponds to minimizing inequality but minimizing joint gain. If a DM were sufficiently motivated by inequality aversion, he or she would produce an inconsistent set of allocations that would result in a shorter vector. The Ring Measure does not address this limitation. A further complication is that in some studies, the Ring Measure had positive and negative outcomes (i.e., the DM was making allocations that could be either benefits or costs). Given the evidence that losses loom larger than gains (Kahneman & Tversky, 1979), DMs may make different tradeoffs when considering positive outcomes versus negative outcomes versus mixed outcomes. Lastly, the presence of losses makes it a challenge to implement the Ring Measure as an incentive compatible decision task, as taking money from research participants is generally verboten.

Fourth, although the Ring Measure produces scores in terms of angular degrees, its final output is categorical. As we discussed earlier, one reason for discarding the continuous information may have been that the conceptual interpretation of a Ring Measure angle is two dimensional rather than unidimensional. That is, the angle summarizes the weight one attaches to the other person's outcomes as well as the weight one attaches to one's own outcomes. If only the right half of the ring is used, an angle's interpretation is unidimensional, referring to the weight one attaches to the outcomes of others in relation to one's own, such that the angle can be used as a continuous SVO score as used by Balliet (2007), for instance. Nevertheless, the Ring Measure in its original form predominates, and so does the unfortunate practice of categorization.

The psychometric properties of the Ring Measure are marginal to weak. In terms of agreement with other SVO measures, Liebrand and van Run (1985, p. 94) reported that only 52.54% of 236 subjects were categorized into the same SVO category by the Ring Measure and another decomposed game procedure (see Kuhlman & Marshello, 1975a). Only when altruists and cooperators were combined did the categorical agreement reach a satisfying level (73%). Murphy et al. (2011) reported acceptable categorical agreement of 67% with the Triple-Dominance Measure and 75% with the Slider Measure (discussed later in this paper). In terms of test–retest reliability, Murphy et al. reported that the Ring Measure categorized 68% of the subjects into the same SVO category at both of two points in time separated by 2 weeks. This result is consistent with findings from Dehue et al. (1993), who reported 70% consistency across a 2-month period. Although SVO as assessed with the Ring Measure has often been shown to be significantly associated with cooperative behavior in social dilemmas (e.g., Liebrand, 1984; Liebrand & van Run, 1985; Offerman, Sonnemans, & Schram, 1996; Sonnemans, Schram, & Offerman, 1998), effect sizes are rarely reported, which hinders the proper estimation of the method's predictive validity.

Circle-Test: A one-item version of the Ring Measure. Sonnemans, Van Dijk, and Van Winden (2006) conducted a study in economic psychology that required participants to complete an SVO measure four times within the context of an ongoing public goods game. To these ends, the researchers modified the Ring Measure so that participants had to make only one allocation decision to yield a joint allocation and concurrently an SVO score. They termed this modified Ring Measure the "Circle-Test." In the Circle-Test, participants were provided with a graphical representation of the SVO Ring on a computer screen (similar to Figure 1). Participants were then requested to make their joint allocation decision by clicking somewhere on the arc of the circle. Once a position was tentatively chosen, the corresponding vector appeared on the screen as an arrow. Participants then could, if they wanted to, change the angle of the vector while seeing how these changes affected the payoff allocations for themselves and the other person. Once a participant found his or her preferred joint allocation, he or she confirmed the decision, and this completed the measurement procedure.

The Circle-Test is a highly efficient measure of SVO, requiring only one allocation choice to yield a continuous score for a person (see also Van Winden, Van Dijk, & Sonnemans, 2008). But one disadvantage of this brevity is that no information about measurement reliability can be gained. As the circle measure has only one item, it is not possible to check whether the choice is transitive or consistent with respect to other choices. The measure does not provide any possibility to assess the magnitude of measurement error and at the extremes cannot assess if a participant responded veridically or randomly. Another limitation is that the changes in payoffs that correspond to movements on the arc are nonlinear. The visual representation is straightforward, but the underlying tradeoffs that occur as a DM moves between different points on the arc are nonintuitive. The arc defining the joint payoffs is necessarily curved (its second derivative is nonzero), thus the joint payoffs change as a DM adjusts the allocation vector as does the rate of change for each of the payoffs. DMs may mitigate this complexity by selecting cardinal points on the circle rather than points consistent with their more nuanced actual preferences. Lastly, secondary preferences about different allocation options remain unknown when using the circle measure, and inequality aversion remains indistinguishable from joint gain maximization.

In contrast to typical practice, Sonnemans et al. (2006) used the SVO angle as the dependent variable rather than using the angle to categorize subjects. As 98% of their subjects' angles ranged between −45° and +45°, using the angle as a unidimensional continuous scale can be justified and is sensible. To our knowledge, no data are available on the Circle-Test's psychometric properties. With respect to the criterion of particular advantages, we acknowledge that the Circle-Test is the briefest method yielding high resolution output. However, given that no data are available on measurement reliability nor validity, it is not possible to evaluate potential drawbacks associated with the method's high efficiency.

Regression and Clustering Approach

Consistent with judgment (e.g., Wyer, 1969, 1971) and conjoint measurement techniques (e.g., Luce & Tukey, 1964;

Radzicki, 1976; Sawyer, 1966), Knight and Dubro (1984) developed a method for assessing social preferences that applies regression and cluster analysis to a set of well-structured preference judgments.

Regression and clustering approach described. To obtain preference data, Knight and Dubro (1984) had participants rate the desirability of joint allocations on a 7-point scale, where the possible allocations were composed of all possible combinations of payoffs ranging from 0 to 6 in increments of 1, resulting in 49 possible joint allocations and the same number of ratings. Then, for each person's ratings, a multiple regression equation was used to model the desirability ratings, using three predictors: own gain (number of cents for self), other's gain (number of cents for the other), and equal gains (difference between the own gain and the other's gain). The resulting regression coefficients were then used in a cluster analysis that yielded six general clusters. These clusters were interpreted as different categories of SVO: equality, group enhancement, superiority, individualism, equality and individualism, and individualism and superiority.

Discussion of regression and clustering approaches. The similarities between the utility measurement approach as proposed by Wyer (1969) and this regression analysis method are clear. In both methods, preference data are used to compute parameter values by a least squares estimation technique. The weights attached to outcome values in the utility functions are conceptually equivalent to the regression coefficients. The novelty of Knight and Dubro's approach is the use of regression coefficients in a cluster analysis to classify people into SVO categories. Given the relatively high median squared multiple correlation coefficients for each of the six clusters, ranging from 0.609 to 0.858, it is clear that participants exhibited substantial consistency in their judgments of the attractiveness of different joint distributions.

One minor drawback with respect to the feasibility of the measure is that Knight and Dubro's procedure, like the utility measure approaches, uses sophisticated statistical tools that may be a barrier for some researchers, especially if SVO is assessed as only one among several different independent variables, for instance. Moreover, this approach categorizes participants into different SVO classes, while the derivation of a unidimensional, continuous scale of SVO that would facilitate analyses is not feasible through this procedure because it represents SVO by a combination of three parameters. Therefore, the results of this technique (a simple categorization of participants) may not be worth the effort of running regression and clustering analyses. Other approaches, discussed previously, yield a similarly resolved output by means of much simpler techniques, challenging this method's efficiency. In addition, we do not see any particular advantage of this method when compared with others.

With respect to the method's convergent validity with other SVO measures, Knight and Dubro (1984) reported that 66.7% of the time the subjects' cluster membership was consistent with their choice patterns in the Social Behavior Scale (Knight & Kagan, 1977) and its triple-dominance variant, the Social Orientation Choice Card (Knight, 1981). To our knowledge, no data on the measure's predictive validity or test–retest reliability are available.

The Sphere Measure From Schulz and May

The Sphere Measure described. On the basis of work on methods for assessing SVO such as utility measurement (Griesinger & Livingston, 1973; Radzicki, 1976; Wyer, 1969, 1971), the Ring Measure procedure (Liebrand, 1984), and the regression and clustering approach (Knight & Dubro, 1984), an additional way of determining people's social motivations was devised by Schulz and May (1989). They differentiated between simple linear SVOs (individualism, sacrifice, altruism, aggression, cooperation, competition), nonsimple linear SVOs (all possible mixtures of simple linear SVOs), simple conditional linear SVOs (maximin and egalitarianism) as proposed by MacCrimmon and Messick (1976), and nonsimple nonlinear SVOs (all possible mixtures of simple conditional and nonconditional linear SVOs). For assessing these SVO types, Schulz and May applied two measurement methods. First they used a pairwise comparison procedure, and thereafter they used a complete ranking procedure with the goal of comparing results from the two methods. Concretely, participants first made pairwise comparisons between all possible combinations of 15 own-other-payoff distributions, resulting in 105 comparisons per participant. After completing the pairwise comparison task, participants rank ordered the same 15 payoff allocations without ties using a graphic presentation of the allocation options. The data from both methods were then combined and evaluated by using a utility model with the general form

$$u(P_S, P_O) = a \cdot P_S + b \cdot P_O + c \cdot \left|P_S - P_O\right|.$$

This utility model is flexible enough to contain all of the archetypical SVO types as special cases. Roughly speaking, while the Ring Measure uses the parameters a and b for calculating the SVO angle on a two-dimensional plane, Schulz and May extended the model with parameter c, thus yielding a three-dimensional model. The third dimension is useful in accounting for conditional SVOs (e.g., egalitarian or maximin). To restrict the model, the authors set the condition such that $a^2 + b^2 + c^2 = 1$, resulting in a model with a spherical geometric representation. Similar to the Ring Measure procedure, participants are then categorized according to their vector directions. In contrast to the Ring Measure, the Sphere Measure vector extends into three-dimensional space and yields a point on the unit sphere rather than a point on a two-dimensional circle.

Discussion of the Sphere Measure. Although Schulz and May (1989) used more sophisticated mathematical tools and a more complicated geometric representation than previous methods, the measure still yields results at only the nominal scale level. Richer results could be extracted from the data of Schulz and May (e.g., transitivity of individual's choice sets, the angle of the projection of the inferred motivational vector on the self/other plane) but unfortunately are not. Furthermore, this measurement method places substantial demands on participants, requiring them to make 105 pairwise decisions about joint payoff allocations, as well as to rank order 15 different self/other allocations. Considering the resolution of the results, these demands are hard to justify. Therefore, we judge the method's efficiency as low.

To our knowledge, no data are available on the Sphere Measure's predictive validity or test–retest reliability. In addition, the Sphere Measure's convergence with other SVO measures has not been tested. However, Schulz and May (1989) reported 75.9% agreement between the subjects' categorization as derived from the ranking procedure and the pair comparison procedure. Hence, there is limited evidence in favor of the Sphere Measure's psychometric quality.

The SVO Slider Measure

Murphy et al. (2011) aimed at constructing a SVO measurement method that combines the strengths of existing techniques while avoiding, when possible, some of their weaknesses. Concretely, they posited that a good measure of social preferences should have the following properties: (a) For pragmatic reasons, a measure should be *easy to administer*. Given that SVO is often assessed as only one variable among a variety of individual differences, the measurement procedure should be time efficient, straightforward, and not require sophisticated mathematical techniques. (b) An SVO measure should be *efficient*, that is, able to assess the most relevant SVOs as reliably as possible while not attending to pathological SVOs that are rarely observed in the wild (e.g., sadistic, masochistic, sadomasochistic). (c) A measure should yield a *unidimensional scale of SVO at the ratio level* that facilitates analyses and comparability. (d) A measure should be highly *sensitive to inter- and intra-individual differences*, which demands high resolution of data. (e) A measure should be able to differentiate between the prosocial preferences of *inequality aversion* and *joint gain maximization*. (f) A measure should check the consistency of a DM's choices in terms of *detecting intransitive choice patterns* as an indication of random responding. (g) A measure should have good psychometric properties, that is, *high reliability and validity*.

The SVO Slider Measure described. The SVO Slider Measure can be administered as an online or a paper-based assessment (see Figures 7 and 8, respectively). It consists of six primary items and nine optional secondary items, all of which have

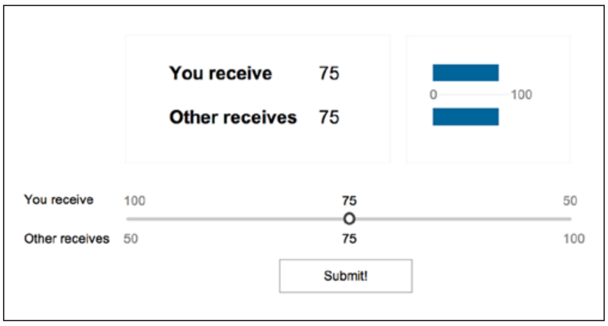

Figure 7. A screenshot of one item from the SVO Slider Measure online version. For this item, the DM is choosing between the individualistic distribution on the left and the altruistic distribution on the right. This item is unique in that there is a constant sum (150) that the DM is allocating between himself and the other person. This kind of choice is a dictator game and it is worth noting that it is contained as an item of the Slider Measure.
Note. SVO = social value orientation; DM = decision maker.

the same general form. Each item represents a specific continuum of own/other payoff allocations that can be explored by sliding across the options within the continuum's boundaries. The DM registers his or her choices by selecting the most preferred joint outcomes. The six primary items reflect the six lines that fully interconnect the coordinates of the empirically most common SVO types (altruistic, prosocial, individualistic, and competitive) in the Cartesian SVO framework with the circle having a radius of 50 and its center at (50,50) as shown in Figure 9. This item configuration allows for computing a unidimensional SVO score, determining the rank order of revealed social preferences, and checking for transitivity in a DM's responses.

After a DM has chosen his or her most preferred payoff allocation in each of the six primary items, the SVO angle can be calculated as follows:

$$\text{SVO Slider } \theta = \arctan\left(\frac{\sum(P_O - 50)}{\sum(P_S - 50)}\right)$$

where P_O is the payoff allocated to the other on an item and P_S is the payoff allocated to the DM. The value of 50 is subtracted from these allocations to shift the center of the ring (50,50) to the origin of the Cartesian plane such that the inverse tangent of the ratio between P_S and P_O yields a readily interpretable index, that is, the individualistic orientation is represented by the angle SVO° = 0. A participant's computed angle is a unidimensional, continuous scale of SVO where higher angular degrees indicate greater concern for the welfare of others, with a lower limit at −16.26° reflecting perfect competitiveness and an upper limit at 61.39° reflecting perfect altruism. If desired, participants' scores can be reduced to one of the four SVO types (altruistic, prosocial, individualistic, or competitive) by means of their SVO angles' values (for the details of this procedure, see Murphy

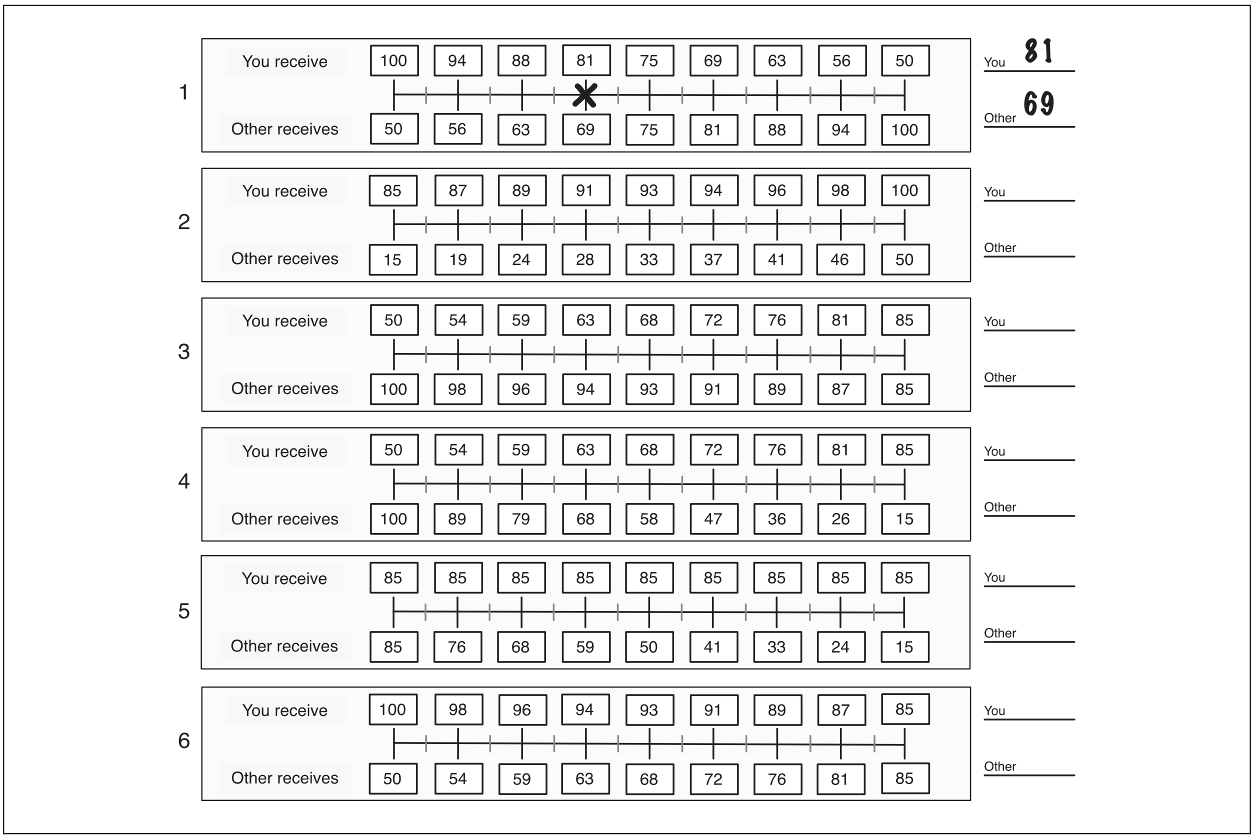

Figure 8. The six primary items of the SVO Slider Measure's paper-based version.
Note. SVO = social value orientation.

et al., 2011) falling within certain ranges. The categorical output may facilitate comparisons of new results with previous findings, but using the continuous scale is strongly recommended for other data analyses.

The nine secondary items of the Slider Measure were constructed for the purpose of detecting inequality aversion and distinguishing it from a preference for joint gain maximization. Both are prosocial preferences, but they are different motivations that may represent different goals for a DM. A graphical representation of these items is shown in Figure 10. The rationale behind the construction of the secondary items is the idea that participants who are inequality-averse will choose allocation options close to the 45° line because these allocations minimize inequality. In contrast, participants who are joint gain maximizers will choose the options that maximize the sum of the payoffs; these points are located each at one of the endpoints of the items with a slope other than −45°. Prosocial participants can then be scored along a continuum from perfectly inequality-averse to perfectly joint gain maximizing. The results from nonprosocial individuals on the secondary items are not additionally informative. For example, individualistic DMs will answer the secondary items in such a way as to maximize their own payoff, which is neither inequality averse nor joint gain maximizing. The secondary items are maximally informative regarding the more nuanced preferences of prosocial DMs.

Discussion of the SVO Slider Measure. With respect to the SVO Slider Measure's psychometric properties, Murphy et al. (2011) reported a test–retest reliability of r = .915 (or 89% categorical agreement) over a 1-week period, and they showed that the Slider Measure outperformed the 9-Item Triple-Dominance Measure and the Ring Measure on that reliability metric. Moreover, the Slider Measure exhibited good convergent validity with these two other measures, categorizing the same participants into the same SVO category as did these measures at least 70% of the time. The Slider Measure also showed moderate but significant predictive validity with respect to the binary choices in a Prisoner's Dilemma game (r_{pb} = .24, Murphy et al., 2011) and excellent predictive validity with respect to contributions in a linear Public Goods Game (r = .47, Murphy & Ackermann, 2013). Because the Slider Measure requires subjects to complete only six items for computing a continuous score, and because the computation of this score is straightforward, we judge the method as efficient.

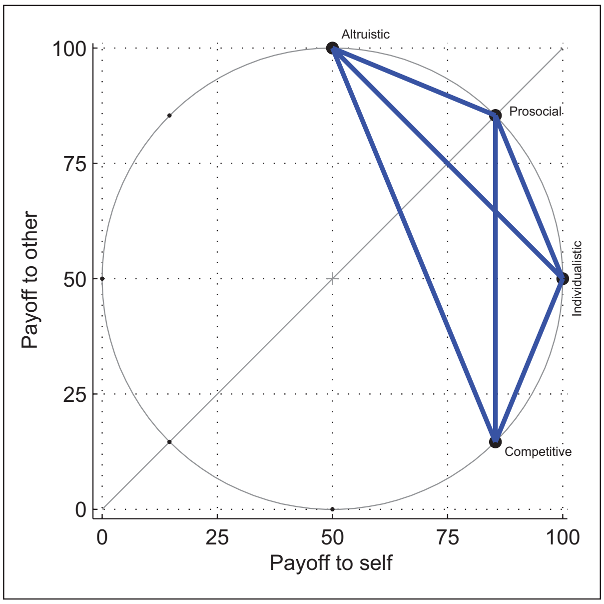

Figure 9. A graphical representation of the Slider Measure's six primary items. These items can be scored to yield an index of social preference on a continuous scale ranging from Competitive to Altruistic. The vast majority of people score in the areas of prosocial and individualistic but there is pronounced and reliable variance within these categories.

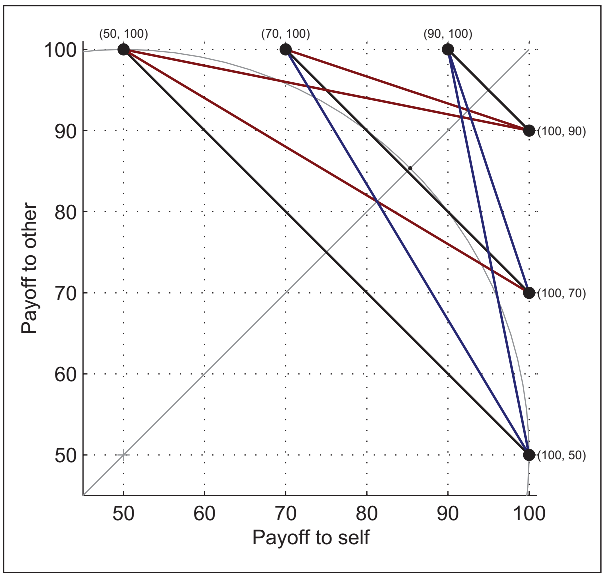

Figure 10. A graphical representation of the Slider Measure's nine secondary items. These items are designed explicitly to disentangle the prosocial motivations of inequality aversion and joint gain maximization and like the primary items yield a score on a continuum between these distinct prosocial motivations.

An additional feature of the SVO Slider Measure is that the data it yields (for primary and secondary items) are amenable to mathematical modeling (see Ackermann & Murphy, 2013). In addition, the data can be checked for violations of transitivity, and rank orderings of SVOs can be computed. Hence, the data produced by the Slider Measure facilitate utility model fitting analyses. Several utility models of other-regarding preferences have been developed in behavioral and experimental economics (see, for instance, Bolton & Ockenfels, 2000; Charness & Rabin, 2002; Fehr & Schmidt, 1999) that include constructs such as efficiency maximizing, inequality aversion, fairness, and reciprocity. The psychological literature related to these same issues has developed in parallel but largely done so independently. Perhaps one reason for this schism is the lack of a common measurement method between the two fields. The SVO Slider Measure could act as a bridge to connect these related but estranged research streams.

One drawback of the SVO Slider Measure is that it does not use a symmetric set of allocation options around the entire ring. As a result, the angular boundaries used for determining which SVO category a person is assigned (when reducing data from the ratio level to the nominal level of measurement) are not at intuitive locations. For example, a perfect altruist is represented by an angle of 61.39° rather than 90°. This asymmetry is a consequence of the measure using only a subset of possible items rather than items that are allocated symmetrically over the whole ring. The measure's validity is unaffected by this asymmetry. It would be possible to extend the Slider Measure in such a way that it would have a symmetric set of items and thus have a rotationally symmetric convex hull of possible scores. Although this extended measure would be more aesthetically pleasing and have intuitive angles as boundaries between the archetypical categories, it would require nearly five times as many primary items (28 vs. 6) and would likely not yield significantly better estimations of DM's social preferences.

A second related drawback of the Slider Measure is that it does not accommodate DMs with atypical social preferences (e.g., a masochistic DM—someone who prefers to minimize his own payoff and is wholly indifferent to the payoff of the other). In situations where destructive kinds of social preferences (e.g., vengefulness, rage, or spite) are of interest, the SVO Slider Measure in its current form is likely an inadequate tool. One could imagine an extended version of the Slider Measure that spanned a greater portion of the self-other allocation plane, but such a scale has neither been developed nor normed empirically yet. Furthermore, the Slider Measure cannot easily be used to assess the social preferences of people who are inexperienced with numeric representations. The method in its current form is therefore likely not suitable for studying social preferences in young children or persons who are illiterate, for example.

Table 4. Summary of SVO Measure Evaluations.

SVO measure	Psychometric properties	Output resolution	Efficiency	Special features
Altruism Scale	–	0	0	No numerical requirements
Triple-Dominance Measure	+	–	+	n/a
Rank correlation technique	n/a	–	–	Rank ordering of SVOs
Utility measurement	n/a	+	–	Flexibility
Indifference curve assessment	n/a	n/a	–	Flexibility
Social Behavior Scale	0	–	+	No numerical requirements
Ring Measure	+	–	–	Assessment of pathological SVOs
Circle-Test	n/a	+	+	Brevity
Regression and clustering	0	–	–	n/a
Sphere Measure	n/a	–	–	n/a
Slider Measure	+	+	+	Continuity, transitivity check, and rank ordering of SVOs

Note. SVO = social value orientation; n/a = not applicable.

Summary of SVO Measure Evaluations

Table 4 shows an overview of the SVO measurement methods we have discussed. The overview is supplemented with information about the measures' performance according to our set of criteria. In the table, minus signs (–) indicate unsatisfactory performance, zeros (0) indicate satisfactory or medium performance, and plus signs (+) indicate good performance. If no or insufficient information is available to judge a measure with respect to a certain criterion, this is indicated by a "not-available/not-applicable" sign (n/a). Regarding special features, the note indicates a measure's particular or noteworthy comparative advantage. It is also used for evaluating output resolution of the indifference curve assessment technique because this method produces visual output for which quantification is possible but requires further complex computation. We are aware that the assignments of performance indications in this table are subjective to a certain degree. However, the information in this table should not be regarded as a substitute for the detailed measure discussions provided throughout this paper. Rather, it is intended to help the reader quickly assess the measures' relative strengths and weaknesses at a glance. In addition, special features of the measures are highlighted to facilitate choosing a method that is best suited for addressing a particular research question or using a particular experimental design. However, as a general principle, we strongly suggest that researchers use methods that produce continuous output whenever possible. This way, the SVO construct is measured as it is theorized and statistical power is not unnecessarily diminished, undermining evidence for an important individual difference.

Discussion

The arc of scientific knowledge is bound by our ability to measure things. This paper is about measuring social preferences, a fundamental concept in the social and behavioral sciences. We have described the concept of SVO and discussed how this construct has been shaped by its measurement. Furthermore, we have provided an overview of ways in which social preferences have been measured and highlighted the strengths and weaknesses of existing measures. We have also discussed a new measure of social preferences called the SVO Slider Measure that overcomes many of the limitations of previous measures and aims to bridge different research streams by establishing a common language for theory and testing.

Social preferences are critical to understanding how DMs allocate scarce resources to themselves and others. The postulate of narrow self-interest is a point conjecture (just one value), namely that *all* DMs have *exactly zero* interest in the outcomes of other people and try only to maximize their own payoffs. Although this is a useful baseline assumption that facilitates tractable models with precise predictions and in many cases works well as an "as if" model (Erev & Rapoport, 1998) of decision making, it often fails to account for, or even roughly approximate, real DM's choice behavior. People's preferences are often much richer, more nuanced, dynamic, and complex than narrow self-interest (see, for instance, Camerer & Fehr, 2006). Although simplifying assumptions are useful for model development, and this conjecture can serve as a very useful starting point, descriptive accuracy and theoretical insight are better supported by the development of empirically accurate descriptions of people's real preferences and motivations. High resolution measurement methods can provide rich data that can be brought to bear on debates about human motivations that are fundamental to understanding and predicting behavior in a wide variety of settings. For example, knowing DM's individual preferences for prosocial outcomes can explain, in part, people's willingness to cooperate in social dilemmas (Balliet et al., 2009; Murphy & Ackermann, 2013; Murphy et al., 2011).

Our review of the literature highlights that social preferences is a rich theoretical construct that can be measured in a variety of ways. Moreover, this construct is of great interest across disciplines in the social, cognitive, and behavioral sciences. Currently, the 9-Item Triple-Dominance Measure is the most popular method for measuring social preferences, but it yields a nominal level of measurement that is often then reduced further to a simple binary result (prosocial vs. individualist). This measurement method constrains thinking and theorizing about social preferences and hampers the development of better theories to account for how people make tradeoffs when outcomes are interdependent, and how big of tradeoffs they are willing to make. Paraphrasing Maslow (1966),[11] if the only tool you have is a hammer, then everything looks like a nail. Along the same line, if the only measurement method one has for social preferences yields a categorical outcome (prosocial or individualistic), then thinking about social preferences veers toward thinking in terms of either/or. This binary approach to contemplating individual differences and preferences is profoundly limiting. First, it limits statistical power, likely contributing to the file drawer problem (Cohen, 1983; Rosenthal, 1979), which undermines our understanding of the importance of nonselfish preferences in human behavior. Second, it discourages thinking about this rich theoretical construct in a continuous way. The misfit between the theoretical conceptualization of a continuous individual difference variable and the predominant measurement method (which in standard practice is dichotomous) yields theories, experiments, and data that tend to be binary when the reality is continuous. Simply put, we all can do better.

Moreover, any static point conjecture about social preferences is inadequate, not only in accounting for different people having different tastes but also in addressing how these preferences change for a person in different situations and contexts, and with the availability of new information. The dynamics of how people's preferences change (Murphy & Ackermann, 2013), and what factors affect interdependent DMs' willingness to make different tradeoffs (Ackermann, Fleiss, & Murphy, 2013), are of central importance to unraveling the roots of cooperation and conflict (Pennisi, 2005). However, the detection of gradual changes in a person's concern for the well-being of others is impossible with methods that are only able to detect categorical shifts. How social preferences are malleable and reactive is an important and deep question, and efforts to address it empirically require high fidelity measurement methods.

The notion that a DM's utility is not only exclusively a function of his or her own material well-being but also affected by the well-being of others is not a new idea ("No man is an island . . ."). Edgeworth (1881) explicitly postulated this notion and anticipated a wide range of social preferences along a continuum. A substantial body of evidence has been built showing the pervasiveness and importance of social preferences and the descriptive inadequacy of narrow self-interest (e.g., Cameron, Brown, & Chapman, 1998; Declerck & Bogaert, 2008; De Dreu & Boles, 1998; Eisenberger, Kuhlman, & Cotterell, 1992; Joireman et al., 2004; Kanagaretnam, Mestelman, Nainar, & Shehata, 2009; Kuhlman & Marshello, 1975a, 1975b; Roch & Samuelson, 1997; Van Lange, Bekkers, et al., 2007; Van Lange, De Cremer, et al., 2007; Van Lange & Visser, 1999). A current challenge is to transcend *Homo economicus* by quantifying Edgeworth's fraction by using valid, reliable, and efficient methods to measure the degree of entanglement in DM's utilities and thus constructively expand theories of social decision making that can accommodate the richness and dynamics of real people's social preferences.

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Notes

1. Dominance refers to the situation where one choice option is better than another choice option on all attributes. Dominance is a fundamental concept in decision theory and game theory. It is anticipated that decision makers will always choose dominant options and never choose dominated options. However, what makes some options better than others is a function of different subjective preferences and tastes, something we concern ourselves with here in this paper.
2. One thing that is worth noting is that in the economics literature, the term altruistic encompasses any positive other-regarding preferences, whereas in the psychology literature there is a distinction made between prosocial and altruistic orientations. For this paper we too will maintain the distinction between these two motivations, using altruistic to refer to the particular archetypical motivation of maximizing another's payoff, indifferent to one's own, and prosocial to refer to the preference of maximizing joint gains (e.g., the sum of all payoffs).
3. The model has the following general form: $U(x, y) = f(x) + g(x - y)$. According to Messick and McClintock (1968, p. 15), "joint gain is ignored in this model [. . .] also as a result of the data previously reviewed which indicate that relative-gain maximization is a more important choice determinant than joint-gain maximization."
4. The phrases in quotes are taken from Van Lange, Otten, De Bruin, and Joireman (1997) which is a well-known and widely cited work regarding social value orientation. The phrases serve to highlight the divergence between measurement and theory that is common in SVO research.
5. To be precise, Sheldon (1999) used the Kuhlman-Teta Measure, which can be seen as a precursor of the 9-Item Triple-Dominance Measure.
6. The data from Murphy, Ackermann, and Handgraaf (2011) allow for a comparison between the different scoring procedures. To facilitate a comparison, the categorical data from the normal scoring procedure are treated as ordinal, or dichotomous (combining competitors and individualists). The test–retest reliability of the Triple-Dominance measure is $r_{spearman} = .801$, or $r_{phi} = .798$, respectively. However, the Pearson correlation

between the number of cooperative choices at Time 1 and Time 2 is only $r = .692$, and between the sum of payoffs allocated to the other at Time 1 and Time 2, it is $r = .621$.

7. *Rationalizable* implies that a DM's set of choices are entirely consistent with some parameterized underlying latent preferences as defined by clear axioms or some other rigorous formulation (see Afriat, 1967; Varian, 1982).
8. The conditions at the two points in time varied slightly. In one condition, the receiver was imaginary, and in the other condition there was a real and visible, but passive, receiver.
9. Liebrand (1984) used 16 equally spaced pairs of outcomes on each of two circles (A and B) with radii of \$7.00 (circle A) and \$8.50 (circle B), resulting in a total of 32 outcome pairs as choice allocations. These results are obtained with additional
10. These results are obtained with additional analyses of data from Murphy et al. (2011).
11. Maslow's (1966, p. 15) exact quotation is "I suppose it is tempting, if the only tool you have is a hammer, to treat everything as if it were a nail."

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